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ABSTRACT

Materials, including curriculum units, are provided for the natural resources and aquaculture components of the vocational agriculture curriculum. Aquaculture is a new component, added because of increased recognition of the opportunities offered by Connecticut's rich shoreline resources. A brochure and flyer on the aquaculture program follow a promotion packet containing the basic materials needed to "pitch" the program to the news media. Sample letters and media presentations are included. The curriculum for both components consists of these units: 3 exploratory and 18 specialized natural resources units and 16 exploratory and 13 specialized aquaculture units. Exploratory units are generally appropriate for grades 9 and 10; specialized units are designed for grades 11 and 12. Each unit has these components: unit title, length (time), when taught (grade and semester), student objectives, related job titles and relevant competencies, content outline, teacher and student activities, evaluation recommendations, a listing of resources, bibliography, and media list. Representative natural resources topics include conservation; forestry; wildlife management; outdoor safety; Christmas tree production; fish culture; forest fires; forest harvesting, measurement, products, protection, soils, surveying and land measurement; game bird propagation; recreation; and timber management. Representative aquaculture topics are boat handling, first aid, pipe fitting, rope splicing, knot tying, cranberry culture, fish culture, metals and welding, tides and currents, aquaculture business management, boat repair and maintenance, boat building, saltwater fishing, and lobstering. (YLB)

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REVISING AND UPDATING THE NATURAL RESOURCES AND AQUACULTURE COMPONENTS OF THE CONNECTICUT VOCATIONAL AGRICULTURE CURRICULUM

Prepared by

AGRICULTURAL EDUCATION PROGRAM
DEPARTMENT OF EDUCATIONAL LEADERSHIP
SCHOOL OF EDUCATION
UNIVERSITY OF CONNECTICUT
STORRS, CONNECTICUT

Prepared for

CONNECTICUT STATE DEPARTMENT OF EDUCATION
DIVISION OF VOCATIONAL, TECHNICAL AND ADULT EDUCATION
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All opinions expressed reflect the views of the authors and are not necessarily those of The State Department of Education.

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June, 1986

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PREFACE

This printing of the Natural Resources and Aquaculture components of the suggested Connecticut Vocational Agriculture Curriculum has been designed for use in the Connecticut Regional Vocational Agriculture Centers. These centers are multi-staffed with three or more teachers of Vocational Agriculture who have each developed an expertise in one or more of the major areas of agriculture. The curriculum is based on the major areas of agriculture as being Animal Science, Plant Science, Agriculture Mechanics and Natural Resources.

This printing includes a new major area of emphasis, namely, aquaculture. The aquaculture component has been added because of the increased recognition of the many and varied employment and entrepreneurship opportunities offered by the rich shoreline resource of Connecticut. As printed the aquaculture units could be taught as one of the major areas of specialization in a regional vocational agriculture center or as a specialty curriculum designed specifically to focus on vocational agriculture and marine science related occupations.

A full program of Vocational Agriculture is based on four years of enrollment. The student would, in the first two years, be enrolled in exploratory units of study covering all four major areas of study. Development of fundamental skills would be stressed during the exploratory units.

The third and fourth year of enrollment would be made up of an election of units designed to best prepare the individual student to meet his or her vocational objective in agriculture.

Students enrolled in the program will be involved in areas of study common to all of agriculture. These areas include career awareness, agricultural business management, leadership development through involvement in the Future Farmers of America chapter and the practical application of units studied through involvement with the supervised occupational experience program.

The Natural Resources and Aquaculture Components of the Connecticut Vocational Agriculture Curriculum are the first to be revised since the curriculum was first printed in the early 1980's. Plans have been made to revise and update other major areas of the Connecticut Vocational Agriculture Curriculum in subsequent years.

This revision includes the integration of a new section in each unit of instruction entitled, "Related Job Titles and Relevant Competencies" for both Natural Resources and Aquaculture. The section is designed to highlight for teachers and students the potential employment or entrepreneurship job titles and relevant competencies needed for employment or self-employment success. The job titles and relevant competencies were identified and validated in the National Agriculture Occupations Competency Study and are included as an integral part of the curriculum.

PROMOTION PACKET

NATURAL RESOURCES AND AQUACULTURE

CONNECTICUT VOCATIONAL AGRICULTURE CURRICULUM

PROMOTION PACKET

NATURAL RESOURCES AND AQUACULTURE

CONNECTICUT
VOCATIONAL AGRICULTURE
CURRICULUM

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Revising and Updating the Natural Resources and
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Vocational Agriculture Curriculum

June, 1986

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PUBLIC RELATIONS PLAN FOR AQUACULTURE

In this packet you have the basic materials necessary to 'pitch' the story of your AQUACULTURE program to the news media. The more, and better, the materials you provide the media, the greater likelihood you have that they will be used.

The news release and brochure act as your basic overview tools. They provide a good understanding of what the program is about. The flyer is useful as a handout.

The materials were designed as if the program was ongoing. If your purpose in promotion is to elicit community response to such a program were it to be offered, then you must adapt the materials accordingly.

Attached is a listing of media available statewide. You will obviously target the information to the media in your particular area.

Don't think of the newspaper as the only source for disseminating information. Today there are more local opportunities than ever, with the proliferation of radio stations and cable systems. Let's look at the approaches to the various media.

NEWSPAPERS

Weeklies and dailies. Make sure you know the various papers serving your region. Send them all notices regarding meetings you're having to explore the curriculum with the public; encourage the city desk or the education writer to do a story about what could be offered if the citizens of the area supported it; and, perhaps, encourage parents to submit letters to the editor indicating their hope that such a program is implemented locally. There is no reason, particularly in shoreline communities, not to provide the editorial page editor with all the material about the program and as editor of the paper, to editorialize the benefits to the community.

If you have portions of the curriculum in place, invite the newspaper to visit your school(s) and take photos of students engaged in AQUACULTURE-related activities. Make sure you submit a copy of the AQUACULTURE logo with all of your materials. Newspapers like to dress up their pages with visually appealing materials.

RADIO STATIONS

AM's and FM's. Get to know the formats of the local stations. In that way, the material you send them can be more appropriate. Most FM's concentrate on music. Therefore, they often want short public service announcements. Examples are included in this packet. Provide them neatly-done material. Many AM's have talk-oriented formats, which encourage live or taped interviews. Contact the station and try to arrange for such interviews for appropriate persons on your staff. Work as closely with the local radio stations as you do the local newspapers. You can often find radio public service or news directors to be more amenable to your information than the local newspaper editor.

CABLE SYSTEMS

Many cable franchises do programming for the community on their local origination channel. Seek out the program director of that channel to work out such an arrangement. All systems have a responsibility to maintain a public access channel which will air materials produced by community organizations. Have your media department work with you on a thirty-minute program about AQUACULTURE which you can present to the cable system for public access. Then get information to parents letting them know when it will be on. Have the cable system air it several times, so parents can tune in at a time convenient to them. Cable stations also run PSA messages.

TV STATIONS

While, in Connecticut, most stations are serving the Hartford market, many are licensed to local areas. WTXX-Channel 20 is licensed to Waterbury. It does much community service for that area. A new station, Channel 26, is starting soon in New London. WTNH-Channel 8 serves the New Haven and shoreline communities. Your packet has enough material to approach the stations seeking a public service spot or announcement to encourage support for the development of a local AQUACULTURE curriculum.

CAUTION

The mass media such as TV, radio, cable or newspapers may not be the best means for getting your message across. Targeting of information to enlist the support of parents, school board members and other opinion leaders is often more effective than an article in the newspaper. The combination of targeted information and media attention to the same issue is a powerful one. Coordinate your release of information for the most impact possible in your community.

LETTER TO MEDIA

Dear (Newspaper Editor) (Public Service Director-Radio/TV):

Enclosed please find materials regarding the new AQUACULTURE program available to public high school students at the ________________ regional vocational agriculture center.

The course--which begins in the 9th grade and continues through 12th grade and may include out-of-school youth and adults--teaches students what they need to know to make a living from the sea. It was designed specifically by Connecticut educators for Connecticut students, in recognition of our rich shoreline and coastal waters.

We hope that our materials reach 7th and 8th graders and their parents as they contemplate and plan their high school careers. AQUACULTURE, as part of the vocational agriculture program, is studied one or two periods a day. The remainder of the day students take regular high school offerings.

We feel that this program is unique and deserving of public attention. If I can answer any of your questions about it, please call me at ____________________.

Sincerely,

FOR RELEASE

AQUACULTURE COURSE DESIGNED FOR CONNECTICUT'S HIGH SCHOOL STUDENTS, OUT OF SCHOOL YOUTH AND ADULTS

High school students across the state will have the opportunity to study aquaculture, a new curriculum of the vocational agriculture program which explores all of the varied skills and industries associated with making a living from the sea.

From freshman to senior year students take a variety of courses such as boat handling, rope splicing and knots, tides and currents, shellfish, fish management, fresh and tidal water surveys, lobstering and boat building. Special programs are also available to out of school youth and adults.

The curriculum, developed in 1985, is being offered at the vocational agriculture center. Public high school students served by those centers can take AQUACULTURE for one or two periods a day. The remainder of their studies consists of traditional high school courses.

The program was developed for Connecticut students by Connecticut educators and industry leaders.

Roger Lawrence, vocational agriculture consultant for the Connecticut State Department of Education, said that "there are many opportunities for meaningful employment for students who want to work in areas associated with our state's rich shoreline and coastal waters."

Lawrence said that some of the careers awaiting graduates of this program would be commerical fishing, boat building, marina management, piloting of a ship and seafood wholesaling.

The AQUACULTURE curriculum incorporates various aspects of natural resources and agricultural mechanics, also part of the vocational agriculture program. Other courses in this field include plant science and animal science.

Classroom work in AQUACULTURE is enhanced by a supervised occupational experience program. The student is required to have a work experience beyond the school day and/or usual school year. The work experience program must be in a field related to vocational agriculture studies.

"We feel this is an exciting field of study which will really capture the imagination of the students," Lawrence said.

The regional vocational agriculture centers offering the program include:

____

____

For further information, call __________________________.

LETTER DESCRIBING THE PROGRAM

Dear (Parent) (Principal):

AQUACULTURE.

That term applies to all of the varied skills and industries associated with making a living from the sea. Now, AQUACULTURE studies are available to high school students through their vocational agriculture program.

Young people will learn about specialties ranging from boat handling, repair and building to lobstering, shellfish and cranberry culture. The entire curriculum--from freshman to senior year, and including out of school youth and adults--is designed to build a deep understanding and interest in the many facets of marine and oceanic studies and to help students to become employable in the industry.

All of this is accomplished while students remain enrolled in the total high school program. Their AQUACULTURE studies constitute one or two periods a day.

The program is brand new. It was developed for Connecticut by Connecticut educators and industry experts. It recognizes the many opportunities for meaningful and rewarding employment for adventurous young people who want to work in areas associated with Connecticut's rich shoreline and coastal waters.

The vocational agriculture program has been most successful at imparting a wide range of knowledge and skills to students at eighteen regional centers throughout the state. AQUACULTURE, its newest offering, incorporates important aspects of the natural resources and agriculture mechanics studies, to make students aware of all they need to know in this fascinating field.

AQUACULTURE offers unique hands-on experience for students interested in exploring a whole new world.

To find out more, contact the vocational agriculture department in your local school district or write to the Connecticut State Department of Education, Bureau of Vocational Services, P.O. Box 2219, Hartford, CT 06145.

Sincerely,

LETTER EXPLAINING PROGRAM TO SCHOOL ADMINISTRATORS AND MEMBERS OF BOARDS OF EDUCATION

Dear Superintendent/Board Member:

I am pleased to inform you of a new program, the AQUACULTURE curriculum, offered by vocational agriculture centers. As the name implies, courses relate to the varied skills and industries associated with making a living from the sea.

The program was developed for Connecticut students by Connecticut educators and industry leaders. It recognizes the many opportunities for meaningful and rewarding employment or entrepreneurship opportunities for adventurous students who want to work in areas associated with our state's rich shoreline and coastal waters.

Young people will learn about specialties ranging from boat handling, repair and building to lobstering, shellfish and cranberry culture. The entire curriculum--from freshman to senior year--is designed to build a deep understanding and interest in the many facets of marine and oceanic studies and to help make students employable in the industry.

As with other vocational agriculture studies, all of this is accomplished while students remain enrolled in the total high school program. Their AQUACULTURE studies constitute of one or two periods a day. Out of school youth and adults may also participate in the program.

We believe that our current vocational agriculture programs have added a new dimension to students from school districts participating in the program. AQUACULTURE, our newest offering, incorporates important aspects of the natural resources and agriculture mechanics studies, to make students aware of all they need know about this fascinating field.

Enclosed please find materials describing the program in more detail. We do look forward to your participation and support. AQUACULTURE offers unique hands-on experience for students interested in exploring a whole new world.

Please feel free to call me or write if you have any questions regarding the program.

Sincerely,

LETTER DESCRIBING THE PROGRAM

Dear Employer in Aquaculture-Related Industry:

-------- ------------- School District (System) is pleased to inform you that we are preparing to offer high school students and out of school youth and adults an exciting new learning opportunity in the field of AQUACULTURE. The curriculum, which is part of our vocational agriculture program, applies to the varied skills and industries associated with making a living from the sea.

Our young people will learn about specialties ranging from boat handling, repair and building to finfish, lobstering and shellfish culture. The entire curriculum is designed to build a deep understanding and interest in the many facets of marine and oceanic studies and to help students to become employable in the industry.

When they complete their studies our students will be able to pursue careers ranging from commercial fishermen to boat builders.

The program was developed for Connecticut students by Connecticut educators and industry leaders. It recognizes the many opportunities for meaningful and rewarding employment for adventurous young people who want to work in areas associated with Connecticut's rich shoreline and coastal waters.

The enclosed brochure describes the various aspects of the program. We will seek your support in providing our AQUACULTURE students with the appropriate occupational experience in the 'hands-on' phase of the program. You may also help by becoming a member of our consulting committee or by identifying potential students. After all, our goal is to sustain and expand the AQUACULTURE industry in Connecticut by insuring you of qualified workers in the future.

We will need the support of local businesses concerned about this field to make this program work over the long term. Your expertise will be invaluable to us.

Sincerely,

RADIO PUBLIC SERVICE ANNOUNCEMENTS

:10 SECONDS

HOW WOULD YOU LIKE AN OFFSHORE CAREER? STUDY AQUACULTURE AT ________________ ______________ REGIONAL VOCATIONAL AGRICULTURE CENTER. IT'S FOR STUDENTS WHO WANT TO EXPLORE A WHOLE NEW WORLD!

:15

EVER CONSIDER BECOMING A BOAT BUILDER? OR RUNNING A MARINA? GET A HEAD START IN HIGH SCHOOL BY STUDYING AQUACULTURE. IT'S AVAILABLE AT __________________ ________________ REGIONAL VOCATIONAL AGRICULTURE CENTER. AQUACULTURE...FOR STUDENTS WHO WANT TO EXPLORE A WHOLE NEW WORLD!

:30

EVER CONSIDER BECOMING A BOAT BUILDER? RUNNING A MARINA? OR BECOMING A COMMERCIAL FISHERMAN? GET A HEAD START IN HIGH SCHOOL BY STUDYING AQUACULTURE. IT'S AVAILABLE AT ______________________ REGIONAL VOCATIONAL AGRICULTURE CENTER. YOU'LL ATTEND AQUACULTURE COURSES ONE OR TWO PERIODS EACH DAY AND SPEND THE REMAINDER OF THE DAY TAKING REGULAR HIGH SCHOOL COURSES. AQUACULTURE...FOR STUDENTS WHO WANT TO EXPLORE A WHOLE NEW WORLD! ASK YOU GUIDANCE COUNSELOR ABOUT IT.

RADIO PUBLIC SERVICE ANNOUNCEMENTS

:60

EVER CONSIDER BECOMING A BOAT BUILDER? RUNNING A MARINA? OR BECOMING A COMMERCIAL FISHERMAN? GET A HEAD START IN HIGH SCHOOL BY STUDYING AQUACULTURE. IT'S AVAILABLE AT ______________________________ REGIONAL VOCATIONAL AQUACULTURE CENTER. YOU'LL ATTEND AQUACULTURE COURSES ONE OR TWO PERIODS EACH DAY AND SPEND THE REMAINDER OF THE DAY TAKING REGULAR HIGH SCHOOL COURSES. THE PROGRAM IS DESIGNED FOR ADVENTUROUS YOUNG PEOPLE WHO WANT TO WORK IN CAREERS ASSOCIATED WITH CONNECTICUT'S RICH SHORELINE AND COASTAL WATERS. YOU'LL NEVER BE IN OVER YOU HEAD IF YOU STUDY AQUACULTURE AT ________________________ REGIONAL CENTER. IT'S FOR STUDENTS WHO WANT TO EXPLORE A WHOLE NEW WORLD. ASK YOU GUIDANCE COUNSELOR ABOUT IT.

TV SPOT SCRIPT - :30 SECONDS

EVER CONSIDER BECOMING A BOAT BUILDER?

RUNNING A MARINA?

OR FISHING COMMERCIALLY FOR A LIVING?

GET A HEAD START ON THESE EXCITING CAREERS...AND MORE...BY STUDYING AQUACULTURE THROUGH CONNECTICUT'S REGIONAL VOCATIONAL AGRICULTURE CENTERS.

THE PROGRAM IS OPEN TO HIGH SCHOOL STUDENTS THROUGHOUT THE STATE.

TAKE THESE SPECIAL COURSES WHILE GAINING YOUR TRADITIONAL HIGH SCHOOL DIPLOMA.

AQUACULTURE...FOR STUDENTS WHO WANT TO EXPLORE A WHOLE NEW WORLD!

ASK YOUR GUIDANCE COUNSELOR ABOUT IT.

AQUACULTURE SLIDE PRESENTATION

SCRIPT

VOCATIONAL AGRICULTURE PROGRAMS IN CONNECTICUT HAVE BEEN SUCCESSFUL IN PROVIDING STUDENTS WITH THE OPPORTUNITY TO EXPLORE ALL PHASES OF AGRICULTURE IN THEIR FIRST TWO YEARS OF HIGH SCHOOL.

IN THEIR THIRD AND FOURTH YEARS, STUDENTS HAVE THE OPPORTUNITY TO MAJOR IN MORE SPECIALIZED AREAS OF STUDY.

THE FOCUS HAS BEEN ON:

- *ANIMAL SCIENCE
- *PLANT SCIENCE
- *NATURAL RESOURCES, AND
- *AGRICULTURE MECHANICS.

NOW STUDENTS HAVE ANOTHER OPTION... TO EXPLORE THE WORLD OF AQUACULTURE.

IT'S AN EXCITING NEW COURSE OF STUDY PREPARING HIGH SCHOOL STUDENTS FOR CAREERS IN THE INDUSTRIES ASSOCIATED WITH CONNECTICUT'S RICH SHORELINE AND COASTAL WATERS.

THE COURSE CONSISTS OF FIVE UNITS.

CULTURE FOCUSES ON SHELLFISH: CRANBERRY: FRESH AND TIDAL WATER SURVEYS AND FISH MANAGEMENT.

WHEN LEARNING ABOUT THE NECESSARY GEAR, STUDENTS LEARN ABOUT ROPE SPLICING AND KNOTS; AS WELL AS THE ASSORTMENT OF FISHING GEAR.

THE MARINE LIFE COMPONENT IMPARTS VITAL INFORMATION ON LOBSTERING; SALTWATER FISHING; AND THE FLOUNDER, BLUEFISH AND MACKEREL.

STUDENTS PREPARE FOR CAREERS IN MANAGEMENT THROUGH COURSE STUDY, AS WELL AS AN INDEPENDENT PROJECT.

AND INCORPORATING VARIOUS ASPECTS OF AGRICULTURE MECHANICS INTO THE AQUACULTURE PROGRAM, COUPLED WITH CAREER AWARENESS AND A HANDS-ON OCCUPATIONAL EXPERIENCE PROGRAM, HELP STUDENTS PUT THEIR FUTURE CAREER INTO PERSPECTIVE.

STUDENTS ATTEND AQUACULTURE CLASSES ONE OR

TWO PERIODS EACH DAY AND SPEND THE REMAINDER OF THE DAY TAKING REGULAR HIGH SCHOOL COURSES.

THE AQUACULTURE PROGRAM WAS DESIGNED BY CONNECTICUT EDUCATORS...FOR CONNECTICUT STUDENTS. THE PROGRAM RECOGNIZES THE OPPORTUNITIES FOR PRODUCTIVE AND MEANINGFUL EMPLOYMENT OFF OF THE STATE'S SHORES.

STUDENTS ARE EXPOSED TO COURSES RANGING FROM BOAT HANDLING IN FRESHMAN YEAR TO BOAT BUILDING IN THE SENIOR YEAR.

THE OPPORTUNITIES FOR THESE STUDENTS UPON COMPLETION OF THE COURSE ARE MANY. THEY CAN CHOSE TO BECOME:

COMMERCIAL FISHERMEN

BOAT BUILDERS

WATER QUALITY INSPECTORS

PILOTS OF SHIPS

MANAGERS OF MARINAS OR
COASTAL WATERS

OR SEAFOOD WHOLESALERS,

IF THEY'D LIKE.

OUR WATERWAYS REPRESENT ONE OF THIS STATE'S MOST PRECIOUS RESOURCES. WE'RE INSTITUTING THIS PROGRAM TO INSURE THAT TRAINED AND DEDICATED YOUNG PEOPLE

CARRY ON THE IMPORTANT WORK OF UNDERSTANDING MORE ABOUT AQUACULTURE.

VOCATIONAL AGRICULTURE PROGRAMS ARE LOCATED AT EIGHTEEN REGIONAL CENTERS THROUGHOUT THE STATE. WE HOPE TO HAVE THE AQUACULTURE SPECIALTY AVAILABLE AT AS MANY SITES AS POSSIBLE IN THE COMING YEARS.

COMMITMENTS ARE ALREADY IN PLACE FROM THE FOLLOWING SCHOOL DISTRICTS: AQUACULTURE ISN'T OVER THE HEADS OF MOST STUDENTS. HOWEVER, THE PROGRAM IS DESIGNED FOR HIGH SCHOOL STUDENTS WHO WANT TO EXPLORE A WHOLE NEW WORLD.

CONNECTICUT CABLE TELEVISION ASSOCIATION

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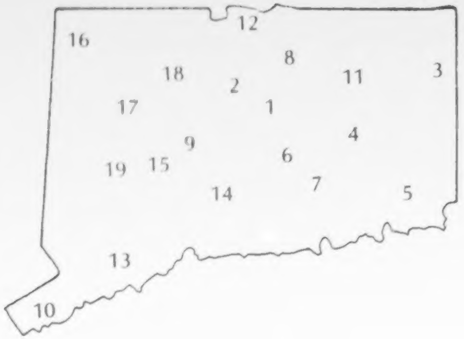
OCCUPATIONAL OPPORTUNITIES IN AQUACULTURE

Boat Builder
Coastal Waters Manager
Commercial Fisherman
Commercial Shellfishing
Fish Conservation Officer
Fish Hatchery Worker
Fisheries Technician
Marina Manager
Marine Equipment Mechanic
Seafood Wholesaler
Water Quality Inspector
Water Safety Instructor

FUTURE FARMERS OF AMERICA

- FFA is an integral part of high school agriculture education classes.
- Founded in 1928, today over 425,000 agriculture students are members of the FFA nationwide.
- FFA strives to develop agricultural leadership, cooperation, and citizenship in its members.



VOCATIONAL AGRICULTURE PROGRAM LOCATIONS:

1 — Glastonbury
2 — Hartford
3 — Killingly
4 — Lebanon
5 — Ledyard
6 — Middletown
7 — Moodus
8 — Rockville
9 — Southington
10 — Stamford
11 — Storrs
12 — Suffield
13 — Trumbull
14 — Wallingford
15 — Waterbury
16 — Region One — Falls Village
17 — Region Six — Litchfield
18 — Region Seven — Winsted
19 — Region Fourteen — Woodbury

OTHER VOCATIONAL AGRICULTURE PROGRAM AREAS INCLUDE:

Animal Science
Natural Resources
Agriculture Mechanics
Plant Science

FOR MORE INFORMATION:

CONNECTICUT STATE
DEPARTMENT OF EDUCATION
BUREAU OF VOCATIONAL SERVICES
P.O. BOX 2219
HARTFORD, CT 06145

Or Your Local Vocational Agriculture Center

NEW!

AQUACULTURE

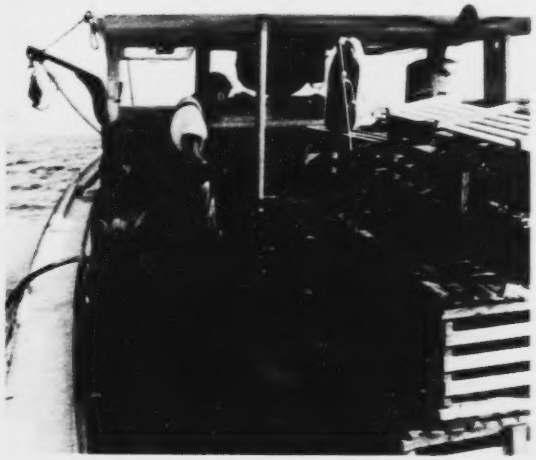
'For High School Students Who Want To Explore A Whole New World.'

Connecticut Vocational Agriculture Program

WHAT IS AQUACULTURE?

It is an exciting new curriculum of the vocational agriculture program exploring all of the varied skills and industries associated with making a living from the sea.

Units of instruction range from boat handling, repair and building to fish, lobstering and shellfish culture.



HOW EXTENSIVE IS THE PROGRAM?

Students attend classes for one or two periods each day and spend the remainder of the day taking regular high school courses. Students explore all phases of vocational agriculture as freshmen and sophomores and can major in AQUACULTURE as a junior and senior. The program is also available to out of school youth and adults.

ACADEMIC LEVELS AND UNITS

FRESHMEN:

Boat Handling
Boating Accidents
Career Awareness
Charts and Compass
First Aid
Future Farmers of America
Marine Life Components
Occupational Experience Program
Pipe and Pipe Fitting
Rope Splicing and Knots
Wood and Tools

SOPHOMORES:

Cranberry Culture
Fishing Gear
Flounder, Bluefish, Mackerel
Fresh and Tidal Water Surveys
Metals
Paint and Fiberglass
Small Gas Engines
Tides and Currents

JUNIORS:

Aquaculture Business Management
Boat Repair
Electronics
Outboard Engines and Boats
Saltwater Fishing
Shellfish Culture
Weather

SENIORS:

Boat Building
Fish Culture
Hydraulics
Independent Aquaculture Project
Lobstering
Piloting
Trailering

OUT OF SCHOOL YOUTH AND ADULTS:

Upgrading, Retraining and Specialized Courses

DOES THE PROGRAM INVOLVE HANDS-ON EXPERIENCE?

Classroom work is enhanced by a supervised occupational experience program. The student will have a work-experience program beyond the school day and/or the usual school year. The work-experience program must be in a field related to vocational agriculture/aquaculture studies.

WHERE DID THE AQUACULTURE PROGRAM ORIGINATE?

The program was designed by Connecticut educators and industry experts for Connecticut students. It recognizes the many opportunities for meaningful employment for adventurous young people who want to work in areas associated with Connecticut's rich shoreline and coastal waters.

JUST WHEN YOU THOUGHT
YOU DIDN'T KNOW ENOUGH
ABOUT THE UNDERWATER WORLD
COMES

AQUACULTURE

AQUACULTURE describes all of the varied skills and industries associated with making a living from the sea. Courses range from boat handling, repair and building to lobstering, shellfish and cranberry culture.

The program was developed specifically *for* Connecticut students *by* Connecticut educators and industry experts. It recognizes the many opportunities for meaningful and rewarding employment for adventurous young people who want to work in areas associated with Connecticut's rich shoreline and coastal waters.

AQUACULTURE studies begin in the student's freshman year of high school and continue through the senior year. As part of the vocational agriculture program, you'll attend **AQUACULTURE** courses one or two periods each day and spend the remainder of the day taking regular high school subjects.

Utilizing skills training from other vocational agriculture program areas, including natural resources and agriculture mechanics, the **AQUACULTURE** curriculum makes students aware of all they need to know in this fascinating field.

For more information on the **AQUACULTURE** program contact the vocational agriculture center in your area or write to:

Vocational Agriculture Consultant
Connecticut State Department of Education
Bureau of Vocational Services
P.O. Box 2219
Hartford, CT 06145

AQUACULTURE

"FOR HIGH SCHOOL STUDENTS WHO WANT TO EXPLORE A WHOLE NEW WORLD."

REVISING AND UPDATING THE NATURAL RESOURCES AND AQUACULTURE COMPONENTS OF THE CONNECTICUT VOCATIONAL AGRICULTURE CURRICULUM

Prepared by

AGRICULTURAL EDUCATION PROGRAM
DEPARTMENT OF EDUCATIONAL LEADERSHIP
SCHOOL OF EDUCATION
UNIVERSITY OF CONNECTICUT
STORRS, CONNECTICUT

Prepared for

CONNECTICUT STATE DEPARTMENT OF EDUCATION
DIVISION OF VOCATIONAL, TECHNICAL AND ADULT EDUCATION
BUREAU OF VOCATIONAL SERVICES
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All opinions expressed reflect the views of the authors and are not necessarily those of The State Department of Education.

June, 1986

PREFACE

This printing of the Natural Resources and Aquaculture components of the suggested Connecticut Vocational Agriculture Curriculum has been designed for use in the Connecticut Regional Vocational Agriculture Centers. These centers are multi-staffed with three or more teachers of Vocational Agriculture who have each developed an expertise in one or more of the major areas of agriculture. The curriculum is based on the major areas of agriculture as being Animal Science, Plant Science, Agriculture Mechanics and Natural Resources.

This printing includes a new major area of emphasis, namely, aquaculture. The aquaculture component has been added because of the increased recognition of the many and varied employment and entrepreneurship opportunities offered by the rich shoreline resource of Connecticut. As printed the aquaculture units could be taught as one of the major areas of specialization in a regional vocational agriculture center or as a specialty curriculum designed specifically to focus on vocational agriculture and marine science related occupations.

A full program of Vocational Agriculture is based on four years of enrollment. The student would, in the first two years, be enrolled in exploratory units of study covering all four major areas of study. Development of fundamental skills would be stressed during the exploratory units.

The third and fourth year of enrollment would be made up of an election of units designed to best prepare the individual student to meet his or her vocational objective in agriculture.

Students enrolled in the program will be involved in areas of study common to all of agriculture. These areas include career awareness, agricultural business management, leadership development through involvement in the Future Farmers of America chapter and the practical application of units studied through involvement with the supervised occupational experience program.

The Natural Resources and Aquaculture Components of the Connecticut Vocational Agriculture Curriculum are the first to be revised since the curriculum was first printed in the early 1980's. Plans have been made to revise and update other major areas of the Connecticut Vocational Agriculture Curriculum in subsequent years.

This revision includes the integration of a new section in each unit of instruction entitled, "Related Job Titles and Relevant Competencies" for both Natural Resources and Aquaculture. The section is designed to highlight for teachers and students the potential employment or entrepreneurship job titles and relevant competencies needed for employment or self-employment success. The job titles and relevant competencies were identified and validated in the National Agriculture Occupations Competency Study and are included as an integral part of the curriculum.

The curriculum is organized and color coded for ease of use. The Natural Resources Units are printed on pink paper, just as they were in the original printing. The Aquaculture Units are printed on green paper. The introductory material and Related Job Titles and Competencies are printed on white paper. The page numbers on the units of instruction are coded as follows:

ER - Exploratory Natural Resources
SR - Specialized Natural Resources
EAq - Exploratory Aquaculture
SAq - Specialized Aquaculture

Exploratory units are generally appropriate for students in the ninth and tenth grades, while specialized units are designed for students in grades eleven and twelve.

The Related Job Titles and Relevant Competencies have two page numbers. They are numbered consecutively at the top. The number at the bottom refers to the Page number in the National Agriculture Occupations Competency Study. This page number is maintained for easy reference to the original document.

The organization for sequence of instruction will be at the discretion of certified teachers, administration, and consulting committee members in each center in accordance with availability of staff and facilities. The primary objective is to serve the individual interests and needs of the students.

The original development of the Natural Resources Component of this curriculum involved the cumulative efforts of the staff of natural resources teachers in Connecticut Regional Vocational Agriculture Centers. Teachers authored the units of study. Each unit was pilot tested by a teacher other than the author. Editing to produce a common format has been done by the teachers. It has not been possible to bring into this revised curriculum all of the information which is available. However, teachers are encouraged to use the curriculum as their basic teaching document and to supplement and enrich the curriculum as appropriate.

The Aquaculture Component of this curriculum was developed by Frederick W. Berggren, a retired teacher of vocational agriculture. As a resident of the shoreline area, Mr. Berggren combined his teaching, practical and curriculum development experience in preparing the Aquaculture curriculum. Special credits are due Dr. Lance L. Stewart and Mr. Timothy C. Visel, of the Connecticut Marine Advisory Service for their input and review of the curriculum units developed.

The Related Job Titles and Relevant Competencies were identified for each unit of instruction by Julia Arab. Much time and effort was spent on identifying those validated activities needed by employed workers to help ensure that the curriculum is competency based.

ACKNOWLEDGMENTS

The Project Director wishes to express his appreciation to these who have contributed to the success and completion of the curriculum.

A sincere thank you is extended to the project staff of Fred Berggren and Julia Arab for the conscientious efforts throughout the project. Special recognition is due to Dr. Patrick B. Mullarney, Head, and Terry A. Mamunes, Secretary, Department of Educational Leadership, whose knowledge of University procedures and expert skills made the completion of the project possible.

Special appreciation is extended to Mr. Roger Lawrence, State Consultant, Vocational Agriculture, Dr. Valerie Pichanick, Project Officer and Mr. Errol Terrell, Chief, Bureau of Vocational Services, for their involvement in the initiation and direction of the study. I would also like to extend my gratitude to Carolyn W. Sikora for her efficiency and expertise in entering the curriculum on the word processor. Her efforts will make future revisions of the curriculum much easier.

Finally, to the teachers of vocational agriculture in Connecticut, for whom this curriculum is designed to serve, appreciation is extended for their cooperation in providing input and support throughout the study.

Dr. Alfred J. Mannebach
Project Director

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NATURAL RESOURCES CURRICULUM UNITS - EXPLORATORY

Conservation of Natural Resources (3 weeks)

Careers - Conservation of soil, water, and natural fauna and flora - Pollution control . . . . ER 1

Forestry and Wildlife Management (3 weeks)

Appreciating forestry and wildlife contributing to mankind - How forests reproduce - Forest products and uses - Careers - Development of wildlife and fish habitats . . . . ER 6

Outdoor Safety (3 weeks)

Avoiding accidents and injuries - Inventory unsafe conditions - Fundamentals of first aid - Red Cross . . . . ER 11

NATURAL RESOURCES CURRICULUM UNITS - SPECIALIZED

Chain Saw Operation and Maintenance (6 weeks)

Skills of operation, upkeep and repair will be taught. Matching kinds of chain saws with work to be done and the safe use of a properly adjusted, well-maintained chainsaw will be stressed. . . . . SR 1

Christmas Tree Production (3 weeks)

Procedures to follow in the establishment and maintenance of a Christmas tree plantation will be taught. Skills involved in harvesting and marketing of Christmas trees will be developed. . . . . SR 8

Fish Culture (3 weeks)

Skills of identifying fish species, their habits and laws pertaining to each will be developed. The setting up and operating of a fish hatchery will be taught. Basic skills of sports fishing will be reviewed. A review of commercial fish farming will be taught. . . . . SR 14

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The skills of cutting, hauling, marketing and carrying out safe practices will be developed. Measuring lumber, writing sales and determining procedures for realizing the greatest return from forest plots will be taught. . . . . SR 23

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Water Supply and Quality Determination (3 weeks)

Determining water supply sources, potential causes of pollution, method of testing for contamination and procedures for maintaining clean water supplies will be taught. Water shed evaluation will be stressed . . . . SR 83

Wildlife Management (6 weeks)

The skills of identifying types of wildlife and their habitat will be developed. How to maintain wildlife and control its harvest will be taught. The ability to handle firearms safely will be stressed . . . . SR 89

AQUACULTURE CURRICULUM - UNIT OVERVIEW

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Boat Units Overview . . . . Aq 3

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Boating Accidents . . . . EAq 5

Charts and Compass . . . . EAq 10

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RELATED JOB TITLES AND RELEVANT COMPETENCIES

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NATURAL RESOURCES CURRICULUM

UNIT: Conservation of Natural Resources

LENGTH: 3 Weeks

WHEN TAUGHT: Grade 9 or 10, Fall or Spring

OBJECTIVES: The student will be able to:

1. define and give three examples of each of these terms: conservation, preservation, utilization, renewable natural resources, non-renewable natural resources and natural resources.
2. explain what is meant by "resource management".
3. describe the duties of three career positions in natural resources conservation.
4. explain what soil is and how it is formed.
5. name the three major plant nutrients and tell how they can be put back when used up.
6. define soil erosion, and the agents that cause it.
7. draw and explain the hydrologic cycle.
8. explain what a water shed is; outline a local watershed.
9. define the term wetland and explain its valuable functions.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Fish Conservation Officer	476 (8, 9)
Fish Hatchery Worker	478 (11)
Fish Research Technician	480 (4b, d, 6a, 7)
Forestry Technician	485 (11)
Soil Conservation Aide	514 (1f, 2)
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Water Treatment Plant Operator	520-521 (1, 2, 5)
Conservation Aide	526 (2)
Wildlife Technician	536 (h)
Christmas Tree Farmer	576 (1f, k)

CONTENT:

I. Identifying natural resources

   A. renewable natural resources
   B. non-renewable natural resources

II. Protecting our natural resources

   A. conservation (wise utilization) of resources
   B. preservation of resources
   C. managing natural resources

III. Identifying soil forming factors

   A. parent material
   B. topography
   C. climate
   D. biotic factors
   E. time

IV. Physical, chemical and biological properties of soil

   A. texture
   B. structure
   C. soil water
   D. organic matter
   E. soil organisms

V. Soil erosion

   A. agents causing erosion
   B. types of erosion
   C. erosion control

VI. Identifying the hydrologic cycle processes

   A. precipitation
   B. transpiration
   C. evaporation
   D. condensation
   E. percolation

VII. Determining watershed properties

   A. groundwater supplies
   B. surface water
   C. wetlands
   D. effects of vegetation on water runoff

VIII. Determining water quality

- A. water pollution
    1. identifying sources of water pollution
    2. identifying effects of water pollution on the total environment
    3. function of wetlands in controlling pollution
    4. mechanical and chemical means of controlling pollution
- B. water testing
- C. water treatment
    1. biological oxygen demand
    2. dissolved oxygen
    3. waste water treatment

IX. Assessing job opportunities available in natural resources

- A. assessing competencies needed for entry level positions
- B. determining educational requirements necessary for employment
- C. determining availability of positions

TEACHER ACTIVITIES:

1. Arrange field trips to areas displaying good and poor erosion control practices.

2. Contact resource persons such as soil conservation, forestry and/or water treatment personnel to speak to class concerning career opportunities.

3. Arrange a field trip to local water treatment facilities.

4. Contact county soil scientist to organize a field trip to observe soil and water conservation practices.

5. Have soil pits and/or soil samples available for students to observe soil horizons, texture and permeability.

STUDENT ACTIVITIES:

1. Define and list at least three renewable natural resources and three non-renewable natural resources.

2. Explain how conservation of natural resources differs from preservation. Site samples.

3. Identify the soil horizons in a soil pit or on a drawing.

4. Visit sites exhibiting different types of erosion. Describe and compare.

5. Take a tour of areas exhibiting soil conservation practices with the county soil scientist.

6. Visit local watershed and later map the watershed area.

7. Explain why all people living in a particular watershed should be concerned about land and water use in it.

8. Make a drawing of the water cycle.

9. Demonstrate at least two of the following actions of water with respect to soil: percolation, capillary action, precipitation, evaporation, and transpiration.

10. Take a field trip to a local water treatment facility.

11. Make a sketch to show the course of home water supply from watershed to tap and on to receiving stream (including passage through waste-treatment facilities).

12. Describe the duties of three careers in natural resources conservation.

EVALUATION:

1. Have the students define and give three examples of the following terms: natural resources, renewable resources, non-renewable resources, conservation, preservation, utilization and resource management.

2. The student should explain the purposes and effects of the soil conservation practices observed.

3. The student should be able to name and describe the three types of soil erosion: sheet, gulley and rill.

4. Have each student draw the hydrologic cycle and explain its importance.

5. After visiting a local watershed, have students map and label the area.

6. Each student should sketch the course of water flow to and from his/her home, beginning with the watershed and ending with passage through a waste-water treatment facility.

RESOURCES:

1. Local water treatment plant operators.
2. Soil Conservation Service personnel.
3. Backhoe might be needed for digging pits.
4. Soil and/or water testing kits.

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2. A Connecticut Water Primer, Connecticut Cooperative Extension Service.
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1. "Soil: Its Meaning for Man", Parts 1 and 2, available from Prentice-Hall Media, Tarrytown, NY.
2. "Land: Its Uses and Values", available from Prentice-Hall Media, Tarrytown, NY.
3. Filmstrip "Soil and the Agricultural Environment", available from NASCO, Fort Atkinson, Wisconsin 53538.
4. Slides of filmstrip, "Pollution, Garbage, Junk, and Man", available from NASCO, Fort Atkinson, Wisconsin, 53538.
5. Transparencies "Small Watershed Management", from Photocam Productions, Pismo Beach, California.
6. "Soils" overhead transparencies, Vocational Education Productions, Cal-poly.
7. Filmstrip "Careers in Agricultural Resources".

NATURAL RESOURCES CURRICULUM

UNIT: Forestry and Wildlife Management

LENGTH: 3 Weeks

WHEN TAUGHT: Grade 9 or 10, anytime

OBJECTIVES: The student will be able to:

1. describe the value of forests as recreational areas and in protecting soils, water resources and wildlife habitat.
2. test the products that we use daily that come from the forest.
3. explain the process of photosynthesis and how a tree grows.
4. identify and describe the functions of phloem, xylem, heartwood, cambium, outer bark.
5. define: hardwood, softwood, coniferous and deciduous.
6. define: board foot, cubic foot, cord, face cord and long cord and be able to use each when buying or selling firewood.
7. describe three occupational opportunities in the forest industry.
8. describe the damage to forests and watersheds by insects, diseases, fire overgrazing, and unwise cutting practices and tell what is being done to reduce or control the damage.
9. identify five native species of fish and five species of wildlife.
10. describe the three welfare factors (food, cover and water) and how they effect wildlife populations.
11. describe five different relationships between man and fish and wildlife.
12. name three local plants useful as wildlife food and name three others useful as wildlife cover.
13. explain: carrying capacity, food web, food chain, consumer, producer, herbivore, carnivore, omnivore, decomposer, plant succession.
14. define fish and wildlife management and tell why it is necessary.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Fish Conservation Officer	475 (3, 4)
Fish Hatchery Worker	477-478 (1, 8b, c, d, e)
Forestry Technician	484 (3, 6)
Commercial Fisherman	497 (8)
Campground Maintenance Person	505 (9)
Hunting and Fishing Guide	512 (5)
Soil Conservation Technician	519 (7, 9)
Conservation Aide	526 (4)
Conservation Officer	529 (3, 4)
Wildlife Technician	535-537 (1a, 2d, e, 10a)
Forestry Aide	540-541 (1)
Sawyer	557 (6f)
Christmas Tree Grower	579-580 (4, 5, 6)

CONTENT:

I. Identifying the values of a forest

A. recreation
B. protection of soil and water resources
C. wildlife habitat
D. forest products

II. Describing how a tree grows

A. parts of a tree

1. crown
2. trunk
3. roots
4. cambium
5. bark
6. xylem
7. phloem
8. heartwood

B. photosynthesis

III. Identifying different types of trees

A. deciduous
B. coniferous

IV. Identifying damage to trees and their effects

A. insects
B. overgrazing
C. diseases
D. fire
E. poor cutting practices

V. Measuring wood

  A. board foot
  B. cubic foot
  C. cord
  D. face cord
  E. long cord

VI. Identifying fish and wildlife species native to Connecticut

  A. fish
  B. mammals
  C. birds

VII. Identifying the needs of wildlife

  A. food

    1. herbivore
    2. carnivore
    3. omnivore
    4. consumer
    5. food chains and food webs

  B. cover
  C. water

VIII. Managing wildlife

  A. identifying problems
  B. carrying capacity
  C. population dynamics

TEACHER ACTIVITIES:

1. Arrange field trips to forest and wildlife management areas.

2. Arrange to have forester, wildlife biologist and/or conservation officer speak with class on field trip.

3. Cut a tree cross section for use by class in identifying parts of trunk.

STUDENT ACTIVITIES:

1. Tell the difference between deciduous and coniferous tree species.

2. Trace out the steps in plant succession in an abandoned field.

3. Take a field trip to a forest management area and discuss needs and procedures with service forester.

4. Identify the parts of a tree trunk from diagrams and trunk sample.
5. List items used daily that are derived from the forest.
6. Measure a cord of wood, a face cord and a long cord.
7. Describe those factors that cause damage in the forest.
8. Identify assigned species of fish and wildlife from mounts, pictures, posters, slides and filmstrips.
9. Report on two species of wildlife. Tell what they require for food and cover, when their mating seasons occur and if they migrate or hibernate in the winter.
10. Describe five different relationships between man and wildlife. Use examples of desirable and undesirable relationships.
11. Describe the following, include examples where necessary: carnivore, herbivore, omnivore, carrying capacity, consumer, producer, decomposer.
12. Draw a food chain for one of these areas: abandoned field, freshwater pond, salt marsh and deciduous forest.

EVALUATION:

1. Students will each draw and label a food chain.
2. Report on two wildlife species.
3. Describe the "steps" in plant succession and how succession effects wildlife.
4. Identify the parts of a tree.
5. Describe forest management practices.

RESOURCES:

1. Local service forester.
2. Soil Conservation Service.
3. Department of Environmental Protection.
4. Wildlife biologist or conservation officer.
5. Firewood to place in cords, etc. for identification; measurements by students.

BIBLIOGRAPHY:

1. Forbes, Reginald D., Forestry Handbook, Ronald Press, 1955.
2. Forestry, Merit Badge Series, 1976, Boy Scouts of America, North Brunswick, New Jersey.
3. Game Gunners and Biology, Olin-Winchester Company.
4. Kircher, H.B., and P.E. McNall, Our Natural Resources, 4th ed., Interstate Printers and Publishers.
5. Management of Forest Resources for Multiple Use, University Park, Penn. Department of Agricultural Education, The Pennsylvania State University, 1970, 124 pages.

MEDIA:

1. "The Deciduous Forest", 2 part filmstrip available from Prentice-Hall Media, Tarrytown, New York.
2. "Managing Wildlife: Is It For You?" filmstrip available from Vocational Education Productions.
3. "The Forest" filmstrip available from NASCO.
4. "Protecting Forests From Insects and Disease" filmstrip available from NASCO.

NATURAL RESOURCES CURRICULUM

UNIT: Outdoor Safety

LENGTH: 3 Weeks

WHEN TAUGHT: Grade 9 or 10, Winter or Spring.

OBJECTIVES: The student will be able to:

1. explain what first aid is and the importance of first aid training.
2. recognize situations in which accidents and/or injuries are more likely to occur.
3. identify the practices that can discourage the occurrence of accidents and injuries.
4. recognize signs and symptoms of the following situations and use accepted first aid techniques in their treatment with competency indicated in the Standard First Aid and Personal Safety by the American Red Cross: treating wounds, specific injuries, shock, administering artificial respiration and cardio pulmonary resuscitation, treating for swallowed objects and choking, treating poisoning, burns, frostbite and cold exposure, heat stroke, heat cramps, heat exhaustion, treatment for sprains and fractures, poisonous bites and plant poisoning, emergency rescue and short distance transfer.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Commercial Fisherman	497 (5, 6)
Fisheries Technician	500 (8)
Campground Manager	502 (6)
Campground Maintenance Person	505 (11)
Park Maintenance Person	509 (2)
Hunting and Fishing Guide	511 (2)
Hunting and Fishing Guide	513 (7)
Conservation Aide	525 (1a)
Conservation Officer	529 (7)
Sawyer	556 (2)
Sawmill Worker	559 (1)
Forest Fire Ranger	565 (3)
Forest Fire Fighter	568 (6)
Smoke Jumper	572 (1, 8)
Forest Fire Suppression, Crew Leader	576 (3, 4)

CONTENT:

I. Introduction to first aid

  - A. definition
  - B. reasons for first aid
  - C. value of first aid training

II. Safety procedures and preventative measures

  - A. safe operation of tools and equipment
  - B. job related accidents

III. Wounds

  - A. definition
  - B. common causes
  - C. symptoms of open and closed wounds
  - D. first aid for open and closed wounds
  - E. first aid for severe bleeding
  - F. prevention of contamination and infection
  - G. bites
  - H. prevention of wound causing accidents

IV. Specific injuries

  - A. eye
  - B. head
  - C. neck
  - D. chest
  - E. abdomen
  - F. back
  - G. genital organs
  - H. legs and feet
  - I. hands

V. Shock

  - A. definition
  - B. causes
  - C. signs and symptoms
  - D. treatment objectives
  - E. first aid

VI. Respiratory emergencies and artificial respiration

  - A. definitions
  - B. causes of respiratory and cardiac failure
  - C. the breathing and circulation process
  - D. artificial respiration
  - E. cardio pulmonary resuscitation
  - F. prevention of respiratory accidents
  - G. swimming safety tips
  - H. boating safety tips

VII. Swallowed objects and choking

- A. causes of choking
- B. signs and symptoms
- C. first aid
- D. prevention

VIII. Poisoning

- A. definition
- B. causes
- C. signs and symptoms
- D. objectives in treatment
- E. first aid
- F. prevention of accidental poisoning
- G. poisoning by marine life
- H. poisonous insect bites
- I. poisonous snake bites

IX. Drugs and their abuse

- A. definition
- B. identification of drug abuse
- C. classification of drugs

X. Burns

- A. definition
- B. causes and effects
- C. classification
- D. first aid
- E. prevention of burns

XI. Frostbite and cold exposure

- A. frostnip
- B. frostbite
- C. hypothermia
- D. prevention of injuries from extreme cold

XII. Heat stroke, heat cramps, and heat exhaustion

- A. definition
- B. causes
- C. heat stroke
- D. heat cramps
- E. heat exhaustion

XIII. Sudden illness

A. heart attack
B. stroke
C. fainting
D. convulsion
E. epilepsy
F. prevention of heart attack and apoplexy

XIV. Dressing and bandages

A. dressings
B. bandages
C. first aid kits and supplies

XV. Bone and joint injuries

A. definitions
B. types of fractures
C. dislocation
D. sprains
E. strains
F. prevention of accidents resulting in bone and muscle injuries

XVI. Emergency rescue and short distance transfer

A. definition of emergency rescue
B. indications for immediate rescue
C. methods of transfer

TEACHER ACTIVITIES:

1. Arrange field trips or guest speakers to discuss the importance of first aid training in their occupations.

2. Arrange for a field trip to a local ambulatory care center emergency room or poison control center.

3. Provide simulated situations for students to apply first aid techniques.

4. Instruct students in Standard First Aid and certify qualified individuals.

5. Arrange for local emergency service personnel to demonstrate first aid equipment, supplies and techniques.

STUDENT ACTIVITIES:

1. Set up simulated wounds using students as patients and have others administer first aid techniques.

2. Prepare a bulletin board showing poisonous and non-poisonous snakes, spiders, insects and plants common to the area.
3. Find the names and addresses of area emergency services, poison treatment centers, etc.
4. Practice artificial respiration and cardio pulmonary resuscitation on resusci-annie.

EVALUATION:

1. Have the students list five agricultural resources occupations and at least four first aid requirements for each occupation.
2. Have each student demonstrate at least four first aid skills assigned by the instructor. Evaluate the students as to correctness of procedure.
3. Have certified Red Cross instructor give test for certification in CPR and/or Standard First Aid.

RESOURCES:

1. First Aid kits.
2. Snake bite kits.
3. Local first aid instructors and emergency medical personnel.

BIBLIOGRAPHY:

1. Emergency Care, Harvey Grant and Robert Murray.
2. Standard First Aid and Personal Safety, The American Red Cross.

MEDIA:

1. Choking, A First Aid Film, American Educational Films.
2. A Life in Your Hands, West Glen Films.
3. The New Pulse of Life, Pyramid Films.
4. First Aid Series, McGraw-Hill

   Introduction to First Aid
   Severe Bleeding
   Stopped Breathing
   Internal Poisoning

5. By Natures Rules, A Film on Hypothermia, Jim Lawless Motion Picture Consultants, Inc. 1545 N.E. 130th Street, Seattle, WA.

NATURAL RESOURCES CURRICULUM

UNIT: Chainsaw Operation and Maintenance

LENGTH: 6 Weeks

WHEN TAUGHT: Grade 11 or 12, late Fall or early Spring.

OBJECTIVES: The student will be able to:

1. identify and explain the basic functions of the major parts of a chain saw and explain the operating principles with accuracy required to properly operate and care for the saw.
2. select the appropriate chain saw to use for a job considering the saw capabilities and the working conditions such as bucking, limbing or felling.
3. use the proper procedures for preparing to start and starting a chain saw, including refueling, to prevent starting troubles and accidents.
4. operate, adjust engine load and working parts and stop a chain saw using procedures which promote optimum engine efficiency and operator safety.
5. properly clean a chain saw to prevent overheating, promote engine efficiency and prevent excessive wear due to dirt entering the engine.
6. prepare a chain saw for storage of three or more months' duration to prevent corrosion and damage.
7. when using operator's manuals, common chain saws and necessary tools, identify the different types of carburetor air cleaners commonly found on chain saw engines and clean and service them according to the manufacturer's specifications.
8. when given a chain saw with a maladjusted carburetor, adjust the idle speed and high speed carburetor adjustments for maximum engine efficiency when cutting.
9. when given carbon-fouled or worn spark plugs from chain saws, service the old plug or select a new one to replace it according to the manufacturer's specifications.
10. sharpen saw chains of the type common to the area with accuracy required to make straight, efficient cuts.
11. remove broken links or damaged saw chain parts and replace them using a punch, hammer and file according to manufacturer's specifications.
12. select, lubricate, adjust and break in a new saw chain according to manufacturer's specifications.

13. troubleshoot problems concerning the saw chain, guide bar and/or sprocket and make needed replacement or repairs on chain saws with worn or malfunctioning parts according to the manufacturer's specifications.

14. replace and/or repair a broken starter rope according to instructions in the operator's manual.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Campgroud Maintenance Person	505 (12b)
Park Aide	507 (5c)
Park Maintenance Person	510 (5b)
Conservation Aide	527 (9c)
Forestry Aide	543-544 (6e, g)
Logging-Skidder Operator	549 (4a, b, e)
Wood Producer	552-553 (5a, 6a)
Forest Fire Fighter	568 (6e, 7)
Smoke Jumper	573 (11, 13)
Christmas Tree Grower	578 (1g)

CONTENT:

I. Identifying operating principles of two stroke cycle engines

A. identifying parts
B. identifying carburetion principles
C. identifying functions of the compression stroke
D. identifying functions of the power stroke

II. Identifying major parts of a chain saw

A. engine parts
B. chain and bar parts

III. Selecting the chain saw

A. determining saw capabilities
B. identifying working conditions

IV. Refueling the chain saw

A. selecting the fuel
B. identifying safety precautions
C. filling the tank using safety precautions

V. Starting the chain saw

A. performing required servicing
B. identifying safety precautions
C. operating starting mechanisms

VI. Operating the chain saw

- A. identifying safety precautions
- B. maintaining proper speed
- C. selection proper load
- D. developing techniques for sawing in different positions
- E. preventing pinching
- F. making minor adjustments
    1. adjusting chain tension
    2. making carburetor adjustments

VII. Cleaning the chain saw

- A. cleaning the outside of the engine, clutch and bar
- B. cleaning the muffler and spark arrester
- C. cleaning the cooling system
- D. cleaning and servicing the air cleaner
- E. identifying broken or excessively worn parts

VIII. Storing the chain saw

- A. preventing corrosion and moisture build-up
- B. preventing gum deposits
- C. preventing dust build-up and physical damage

IX. Servicing chain saw carburetor air cleaners

- A. identifying the type of air cleaner
- B. cleaning the air cleaner element
- C. replacing air filters

X. Adjusting the chain saw spark plugs

- A. adjusting the high speed screw
- B. adjusting the idle speed screw
- C. adjusting the choke

XI. Servicing chain saw spark plugs

- A. cleaning the spark plugs
- B. resetting the gap
- C. selecting a replacement spark plug

XII. Sharpening saw chains

- A. identifying chain parts
    1. joint
    2. gullet
    3. side cutting edge
    4. top cutting edge
    5. pitch

B. identifying the common types of saw chains
    1. chipper-type
    2. chisel tooth chain
    3. other

C. selecting appropriate equipment
    1. scrench
    2. round file of proper size and file guide
    3. flat file

D. maintaining correct angles, depths, and distances

XIII. Repairing broken and/or worn saw chain parts

A. removing parts to be replaced
B. installing new parts
C. adjusting new parts

XIV. Replacing saw chains

A. selecting the new chain
    1. identifying sawing conditions
    2. identifying saw model and bar size

B. lubricating new chains
C. adjusting new chains

XV. Troubleshooting saw chain problems

A. identifying and repairing cutter problems
    1. damaged cutters
    2. incorrectly filed cutters

B. identifying and repairing drive link problems
    1. replacing damaged drive links
    2. replacing sprockets
    3. aligning sprocket and bar groove
    4. adjusting chain tension

C. identifying and remedying tight joints
    1. repairing or replacing guide bar
    2. installing new sprockets

D. identifying and remedying causes of crooked cutting
    1. checking cutters
    2. repairing or replacing guide bars

XVI. Troubleshooting guide bar problems

  A. identifying and repairing solid nose bar problems

    1. repairing splits
    2. reshaping the bar
    3. replacing the bar

  B. identifying and repairing roller nose bar problems

    1. lubricating the roller nose
    2. maintaining side plates
    3. replacing the roller

XVII. Identifying sprocket problems

  A. identifying causes of sprocket problems
  B. replacing worn sprockets

XVIII. Replacing the starter rope

  A. disassembling the unit
  B. installing the new rope

TEACHER ACTIVITIES:

1. Arrange a trip to a local chain saw dealer to view their sales and service operation. Have the owner show students the different brands and models available and the equipment used for chain saw maintenance.

2. Demonstrate all available safety gear and required its use.

3. Arrange for a guest speaker on the topic of the importance of safety in the forest industry.

4. Arrange for a trip to a logging operation to view chain saw operation and safety in the industry.

5. Demonstrate proper felling limbing and bucking techniques.

STUDENT ACTIVITIES:

1. Use a cut-away model of a two stroke cycle engine to observe operating principles and to learn the parts and their functions.

2. Practice adjusting chain saw tension and carburetor high speed and idle speed adjustments.

3. Practice cleaning the air filter, cooling system, clutch, bar and muffler after operating the chain saw.

4. Clean and set a spark plug according to the operator's manual using a spark plug feeler gauge.

5. Practice sharpening saw chains using proper tools and techniques. Check the performance of the chain after sharpening.

6. Practice making needed repairs to saw chains such as replacing links using operator's manual as guide.

7. Given saw model and sawing conditions, determine the replacement chain that would be most appropriate to use.

8. Replace a broken or frayed rope on a chain saw engine.

EVALUATION:

1. Rate the students on their identification and explanation of the operating principles of the different parts of a chain saw and its two stroke cycle engine.

2. Evaluate the safe starting, operating and stopping of a chain saw under field conditions.

3. Evaluate student's performance on minor operating adjustments on a chain saw.

4. Give each student a fouled or worn spark plug to service or replace. Evaluate the students as to how well they service the plug and set the gap or if they select the correct plug to replace the old one.

5. Give each student a worn saw chain to sharpen. Evaluate the student's performance with the necessary depth and angle gauges and by evaluating the performance of the saw as a cut is made.

6. Evaluate the correctness of procedure when replacing a drive link in saw chain.

7. Evaluate students' performance on all procedures outlined in behavioral objectives.

RESOURCES:

1. Chain saws.

2. Common small engine hand tools.

3. Spark plug feeler gauge.

4. Examples of spark plugs.
5. Ignition file.
6. Saw chains and guide bars in disrepair.
7. Saw chain sharpening tools - files, vises, guides and gauges.
8. Cut-away model of a two stroke cycle engine.
9. Air compressor.
10. "Degreaser" solvents.
11. Small engine and chain saw hand tools.
12. Chain saw service manuals and operating manuals.

BIBLIOGRAPHY:

1. Chain Saw Service Manual, Intertic Publishing Corp., Technical Publications Div., Kansas City, MO., 1970.
2. Chain Saw Technicians Workbook, Ken Cook Publications.
3. Forestry Techniques Series, Husgvarna Chain Saw Co.
4. Sarna, R.P., Chain Saw Maintenance
5. Saw Chain Maintenance Manual, Oregon Saw Chain Co.
6. Small Engines, Volume I, American Association for Vocational Instructional Materials, Engineering Center, Athens, Georgia, 1968.

MEDIA:

1. Chain saw safety (slides) Hobar Publications.
2. Chain saw maintenance (slides) Hobar Publications.
3. Forest 70 (movie) Jonsered Chain Saw Co.

NATURAL RESOURCES CURRICULUM

UNIT: Christmas Tree Production

LENGTH: 3 Weeks

WHEN TAUGHT: Grade 11 or 12, anytime

OBJECTIVES: The student will be able to:

1. evaluate the market potential and economics of Christmas tree production in his/her area.
2. select appropriate sites for Christmas tree production considering soil requirements, topography and preparation requirements.
3. lay out a Christmas tree plantation in a manner which will facilitate management.
4. identify the different species of Christmas trees in his/her region and indicate their characteristics and market potential.
5. using needed site preparation and planting tools and equipment, prepare a site and plant Christmas tree seedlings with an acceptable survival rate for his/her area.
6. develop and implement a cultural plan for a Christmas tree plantation which will result in vigorous, well-formed trees.
7. develop and implement a protection plan for a Christmas tree plantation to include fire protection, protection from insects and diseases and protection from animals.
8. develop and implement a harvesting plan for a Christmas tree plantation including timing, equipment and storage.
9. develop and implement a marketing plan for a Christmas tree enterprise including developing outlets, making sales contracts and grading.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Forestry Technician	483 (6, 8)
Campground Maintenance Person	504-505 (8, 9)
Park Aide	506-507 (2, 3, 4, 5)
Soil Conservation Aide	515 (5)
Soil Conservation Technician	517-518 (1, 2e, f, g, 3c, h)
Forestry Aide	540-541 (1, 3)
Wood Producer	550 (1)
Forest Insect Ranger	570-571 (2, 3, 4, 5)
Christmas Tree Grower	578-581

CONTENT:

- I. Evaluating the market potential and economics
  - A. locating markets
  - B. developing a budget
    - 1. estimating costs
    - 2. estimating returns
    - 3. determining gross and net returns
    - 4. determining potential income/acre/year
- II. Selecting sites for Christmas tree production
  - A. determining soil requirements
  - B. determining acceptable topography
  - C. identifying drainage requirements
- III. Laying out the plantation
  - A. developing accessibility by making roads and lanes
  - B. determining row and tree spacing
  - C. selecting the direction of rows
  - D. preventing tree border shading
- IV. Selecting tree species
  - A. determining characteristics of desirable trees
  - B. determining market preferences
  - C. identifying Christmas trees
- V. Propagation
  - A. seed sources
  - B. seed collection
  - C. seed storage
  - D. seedbed construction and preparation
  - E. seed germination
  - F. seedling care
- VI. Planting trees
  - A. providing needed site preparation
    - 1. using heavy equipment
    - 2. using hand tools
    - 3. using chemicals
  - B. obtaining and selecting planting stock
  - C. caring for planting stock
  - D. planting methods
    - 1. using hand methods
    - 2. using planting machines

VII. Implementing a cultural plan for Christmas trees

A. controlling competing vegetation

1. operating tools and equipment
2. maintaining tools and equipment
3. selecting chemicals
4. formulating chemicals
5. applying chemicals
6. using domestic animals
7. timing control methods

B. determining cultural needs

1. shearing trees

    a. timing
    b. shearing techniques
    c. operating shearing tools
    d. maintaining shearing tools
    e. debudding trees

2. using colorant sprays

    a. selecting sprays
    b. timing applications

VIII. Protecting the tree plantation

A. developing fire protection and fire suppression procedures

1. selecting suppression equipment
2. safely operating suppression equipment
3. maintaining suppression equipment

B. developing the insect prevention and control program

1. identifying insect pests and their damage
2. using mechanical control methods
3. using chemical control methods

    a. selecting chemicals
    b. formulating chemicals
    c. applying chemicals

C. developing the disease prevention and control program

1. identifying disease symptoms
2. using mechanical control methods
3. using chemical control methods

D. controlling damage from domestic and wild animals

IX. Harvesting

- A. timing
- B. selecting equipment
- C. operating equipment
- D. maintaining equipment
- E. organizing the crew
- F. tying or baling trees

X. Marketing Christmas trees

- A. selecting outlets
- B. grading and labeling trees
- C. marketing techniques
- D. record keeping of income and expenses

TEACHER ACTIVITIES:

1. Plan a field trip to local Christmas tree growers to view management techniques.
2. Plan a field trip to State Experiment Station to view research with Christmas tree production, i.e. weed control.
3. Demonstrate proper Christmas tree production, techniques, i.e. planting, shearing and insect control.
4. Provide for conifer identification practice.
5. Make a long term agreement to use a parcel of land for a Christmas tree plantation.

STUDENT ACTIVITIES:

1. Develop a budget for a Christmas tree enterprise on a designated site after obtaining cost/return data from successful enterprises.
2. Take field trips to potential plantation sites and evaluate them.
3. Have successful Christmas tree enterprise operators as resource persons to discuss methods of laying out a plantation to facilitate management.
4. For a given site, develop a plantation layout considering accessibility, spacing, row direction and shading.
5. Take field trips for conifer identification.

6. Visit a nursery to observe planting stock production and seedling characteristics.

7. Select a site, plant and manage a small number of Christmas trees for personal use.

8. Select chemicals and determine formulations for a given insect or disease problem and situation.

9. Develop an exhibit or bulleting board display of specimens or pictures of important Christmas tree damaging insects.

10. Take a field trip to a Christmas tree plantation and have the owner or an employee indicate examples of each grade of tree.

EVALUATION:

1. Have each student make a budget for a Christmas tree enterprise on a given site.

2. Have each student determine the feasibility of designated site for a Christmas tree plantation by determining soil characteristics, topography and any other pertinent data.

3. Have each student lay out a Christmas tree plantation on a designated site. The plans should consider all pertinent factors about the site and promote ease of management.

4. Develop a practical examination using branches, pictures or live specimens in which the student must identify the different species of Christmas trees important to his/her area.

5. Have each student plant 100 Christmas trees. Evaluate each student on his ability to correctly plant the trees.

6. Have each student shear a Christmas tree for evaluation as to correctness of procedure and observance of safety practices.

7. Have the students identify specimens of Christmas tree insects, indicate the damage caused to trees, and recommend an appropriate control program for each.

8. Evaluate each student's demonstration on their ability to cut, trim and bale a Christmas tree.

9. Develop a practical examination in which the student will grade 10-15 Christmas trees using U.S. standard Christmas tree grades.

RESOURCES:

1. Local Cooperative Extension Service office for Christmas tree production publications.
2. Christmas Tree Producers Handbook, Massachusetts Cooperative Extension Service.
3. Christmas tree seed and seedling companies for copies of their catalogs and price lists.
4. List of materials:

    hard hats
    shearing knives and leg protectors
    chemical sprayers
    fire fighting equipment
    axe
    bow saw
    tree planting bars
    buckets
    land level

BIBLIOGRAPHY:

1. Chapman, A.G. and Wray, R.D., Christmas Trees for Pleasure and Profit, Rutgers University Press New Brunswick, N.J., 2nd edition, 1979.

2. Harlow, William, Trees of the Eastern and Central United States and Canada, Dover Publications, New York, 1957.

3. Wyman, E.P., and Miller, R., Growing Christmas Trees in Connecticut, Cooperative Extension Service, College of Agriculture and Natural Resources, The University of Connecticut, Storrs, Connecticut 06268, 1972.

4. United States Department of Agriculture, Code of Federal Regulations #7, Agriculture

MEDIA:

1. Coniferous Trees, 65 Frames, IL $5.20

NATURAL RESOURCES CURRICULUM

UNIT: Fish Culture

LENGTH: 3 Weeks

WHEN TAUGHT: Grade 11 or 12, Spring

OBJECTIVES: The student will be able to:

1. identify fish species that are propagated in hatcheries.
2. list habits of major fish species.
3. identify laws pertaining to fish.
4. prepare a food purchase to cover fish hatchery needs.
5. determine the chemical properties of water necessary for fish production.
6. plan a food purchase to cover fish hatchery needs.
7. draw a preliminary design of a fish hatchery to take into consideration basic criteria for its development.
8. identify important fish food found in waterways.
9. tie a fly to match natural trout food.
10. tie common knots for line attachment.
11. cast with a flyrod.

RELATED JOB TITLES AND RELEVANT COMPETENCIES

Fish Conservation Officer	475-476 (1a, 3, 4, 6)
Fish Hatchery Worker	477-479
Fish Research Technician	480-481 (3, 4, 6, 7, 9, 10)
Commercial Fisherman	496-497 (2, 4a, 8, 10)
Hunting and Fishing Guide	511-512 (2, 3, 5)

CONTENT:

I. Identify fish produced in hatcheries
  A. determining recognition characteristics
  B. identifying hatchery fish

II. Fish habits
  A. preferred habitat
  B. growth rates
  C. breeding habits
  D. feeding habits

III. Fish laws
  A. equipment usage
  B. legal lengths
  C. seasons
  D. limits

IV. Hatchery design
  A. water source and quality
  B. pool design
  C. quantity of fish in pools
  D. installation of plumbing
  E. hatch house

V. Food
  A. nutrition considerations
  B. quantity of food needed
  C. feeding program

VI. Chemical properties of water
  A. using test kit to determine chemical properties and levels

VII. Diseases and Predators
  A. identifying common fish diseases, parasites and predators

VIII. Eggs
  A. source of eggs
  B. measuring of eggs
  C. handling of eggs

IX. Natural foods

  A. terrestrial foods
  B. natural foods

X. Fly tying

  A. limitation of natural foods
  B. knots

    1. fly attachment
    2. splices

XI. Fly rodding

  A. types of fly rods
  B. types of fly lines
  C. use of fly rods

TEACHER ACTIVITIES:

1. Arrange to have a conservation officer visit to explain laws relating to freshwater fish.
2. Arrange a field trip to a fish hatchery.
3. Demonstrate fly tying and fly rod techniques.

STUDENT ACTIVITIES:

1. Identify fish species commonly found in fish hatcheries.
2. Visit a fish hatchery to observe employees in operation of their duties. Interview manager of the hatchery.
3. After a visit to the hatchery, design a fish hatchery. Each item of the drawing will be labeled with dimensions and fish capacity. A feeding program for each section of the hatchery will be completed/
4. Visit three different streams to measure the chemical properties and relate the values of each to fish production.
5. Tie at least two artificial flies to imitate natural trout food.
6. Practice with fly rod and use their tied flies in actual pursuit of trout.

EVALUATION:

1. Using slides, have students identify important commercial fish species.
2. Have student collect and identify important stream fish food.
3. Evaluate student's results of chemical and physical analysis of stream.
4. Have student draw a fish hatchery and fill out an information sheet concerning number of fish in pools, size of fish, feeding of fish and efficiency factors.

RESOURCES:

1. Have a district fish histologist explain fish stocking procedures and have stream evaluation in area.
2. Use Hach chemical test kits to determine water quality.
3. State fish hatchery.
4. Use of local streams.
5. Conservation officer.
6. Fly tying materials.

BIBLIOGRAPHY:

1. Greenberg, David, Trout Farming, Chilton Co.
2. Lagler, Karl, Freshwater Fishery Biology, Brown Co.
3. Lee, G.S., Commercial Catfish Farming, Interstate Printers and Publishers.

NATURAL RESOURCES CURRICULUM

UNIT: Forest Fires: Prevention and Control

LENGTH: 3 Weeks

WHEN TAUGHT: Grade 11 or 12, early Spring or late Fall

OBJECTIVES: The student will be able to:

1. demonstrate an understanding of fire and its causes.
2. describe the effects of forest fires on plant and animal life, property and soil and water quality.
3. demonstrate the abilities necessary in fire control as well as care and use of equipment.
4. describe means of preventing forest fires.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Forestry Technician	485 (9)
Campground Maintenance Person	505 (12)
Park Aide	508 (12)
Conservation Aide	527 (9)
Forestry Aide	540 (1e)
Forestry Aide	542-543 (4, 6d)
Logging Skidder Operator	546 (1q, r)
Fire Inspector	565-567 (7, 8, 15, 18, 19, 20, 21)
Forest Fire Fighter	568-569
Smoke Jumper	572-573
Fire Warden	574-575 (1, 2, 3, 7, 8, 9, 12)
Forest Fire Suppression-Crew Leader	576-577

CONTENT:

I. Forest fires

  A. fire as a natural phenomenon

    1. history of forest fires and their effect on our present forests
    2. fire triangle
    3. factors influencing forest fires

      a. types and condition of fuels
      b. weather - climate and fire seasons
      c. topography

4. types of forest fires

    a. surface fires
    b. ground fires
    c. crown fires

5. forest fire behavior

    a. burn patterns
    b. relationships to environmental factors

B. effects of forest fires

1. effects on trees

    a. species resistance
    b. lethal temperatures
    c. tree injuries - scars, defoliation
    d. disease and insect damage susceptibility

2. related effects

    a. soils
    b. related vegetative cover
    c. wildlife and wildlife habitat
    d. general forest ecology
    e. beneficial effects

3. first aid for burn victims

II. Forest fire prevention

A. causes of forest fires

1. children
2. incendiary
3. smokers
4. forest recreation
5. equipment use
6. debris burning
7. lighting

B. fire prevention

  1. recognizing and dealing with fire hazards

    a. fuel removal
    b. firebreaks
    c. prescribed burns to reduce flash fuels

  2. education

    a. state and federal forest service
    b. local fire departments
    c. Smokey Bear
    d. civic groups
    e. media

  3. regulation of public use of wild lands

  4. law enforcement

III. Controlling forest fires

  A. fire detection and reporting
  B. crew organization
  C. types of equipment, use and care

    1. backpack pump
    2. fire rake
    3. broom rake
    4. axe
    5. brush hook
    6. mattock
    7. hoe
    8. shovel
    9. chainsaw

  D. methods of forest fire attack

    1. parts of a fire
    2. direct attack
    3. indirect attack

  E. setting up a fire line

TEACHER ACTIVITIES:

1. Arrange to have State Forestry personnel train students in fire control methods.
2. Arrange for a class fire prevention project in a local area, i.e., permanent fire break, forest fire fighting team and educational presentation.
3. Ask local fire department to come to class and exhibit fire fighting equipment.
4. Plan a trip to a local fire lookout tower/fire fighting station and discuss career responsibilities and opportunities with employees.
5. Encourage and demand good fire prevention habits, i.e., smoking, chain saw operation and campfire management.
6. Have students monitor daily fire hazard conditions and publicize.

STUDENT ACTIVITIES:

1. Practice fire line construction following training sessions.
2. Prepare fire prevention activities, posters, etc.
3. Obtain Smokey the Bear outfit and other fire prevention materials from State D.E.P. for use a local open house.
4. Determine fire size and rate of spread in simulated problems and determine where and how to locate fire lines.

RESOURCES:

1. State fire warden or forestry personnel for training of student fire crew.
2. Local fire departments.

BIBLIOGRAPHY:

1. Brown, Arthur A., Davis, Kenneth P., Forest Fire: Control and Use, 2nd edition, McGraw-Hill Book Co., New York, 1973.
2. Forbes, R.D., Forestry Handbook, The Ronald Press, New York, 1955.
3. Manual for Forest Fire Fighters, Northeast Area, U.S. Forest Service.
4. Stoddard, Charles H., Essentials of Forestry Practice, 2nd ed., The Ronald Press, New York, 1968.
5. Water vs. Fire, Fighting Forest Fires with Water, Northeast Area, U.S. Forest Service, Revised 1973.
6. 1975 Wildfire Statistics, October 1976, Northeast Area, U.S. Forest Service.

MEDIA:

1. Films concerning fire fighting practices, used by State Personnel during training season.
2. Transparency masters available from various instructional supply services depicting fire damage and statistics.

NATURAL RESOURCES CURRICULUM

UNIT: Forest Harvesting Practices

LENGTH: 6 Weeks

WHEN TAUGHT: Grade 11 or 12, Fall or Winter

OBJECTIVES: The student will be able to:

1. learn how timber is produced and sold in the Connecticut area.
2. maintain tools involved in harvesting practices.
3. operate harvesting tools.
4. safely and efficiently fell, limb and buck trees for maximum product value.
5. write timber sales agreements.
6. measure gross and net volume contents of logs.
7. plan logging roads, trails and log landings to conserve soil, water and wildlife resources.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Forestry Technician	483-486 (1c, 3a, d, h, k, 4, 14)
Land Use Planning Technician	490 (1a, b)
Campground Maintenance Person	505 (12b)
Park Aide	507 (5)
Park Maintenance Person	510 (5b)
Conservation Aide	527 (9c)
Forestry Aide	541-544 (1p, q, aa, bb, cc, dd, 6e, g)
Logging Skidder Operator	549 (4a, b, e)
Wood Producer	550-553 (1, 2, 5a, 6a)
Sawyer	556-557 (2, 6)
Forest Fire Fighter	568 (63, 7)
Smoke Jumper	573 (11, 13)
Christmas Tree Grower	578 (1g, 6)

CONTENT:

I. Connecticut forest products and occupational opportunity

  A. forest type, history and land area
  B. roundwood products
  C. structural limber products
  D. by-products
  E. sawmill location and types
  F. job descriptions in Connecticut harvesting industry

II. Business management practices for harvesting

  A. timber sales agreements
  B. buying and selling techniques

    1. site bidding
    2. grading timber for buying and selling
    3. log rule selection
    4. writing timber sales contract

  C. harvest plan

    1. road access
    2. timber distribution, topography
    3. legal limitations
    4. division of labor method

III. Harvesting systems

  A. shelterwood harvest cuttings
  B. selection harvest cuttings
  C. rotation harvest cuttings
  D. diameter limit harvest cuttings
  E. disadvantages and advantages of cutting types in given situations

IV. Chain saw maintenance and operation

  A. chain saw parts

    1. variations
    2. advantages and disadvantages of part variations (cutter tooth types, clutches, bar types, etc.)

  B. chain and bar maintenance

    1. tension adjustment
    2. guide bar problems, position, and corrective maintenance
    3. chain problems and corrective maintenance
    4. routine daily maintenance

C. lubrication system maintenance and problems

D. ignition system

1. variations
2. problems
3. field troubleshooting and corrective maintenance

E. fuel system

1. method of operation
2. adjustments
3. field troubleshooting

F. chain saw storage procedures

G. starting and operating procedures

1. hand, foot and body position during starting procedure
2. safety equipment
3. body position during operation of the saw
4. cutting techniques

V. Timber felling practices

A. safety equipment usage
B. felling tool usage

1. axes
2. wedges: plastic, magnesium, wood
3. field adjustment and sharpening tools
4. cant hook

C. standing tree problems

1. head and side lean
2. butt or top rot
3. wind velocity and direction
4. surrounding obstacles

D. clearing fell area

1. brush
2. potential snapper poles
3. other hazardous conditions

E. felling techniques

  1. for sound straight trees
  2. for heavily leaning trees
  3. for trees with butt rot
  4. for trees with top rot
  5. for altering direction of fall away from lean
  6. for "hung" trees
  7. for trees with "setback"
  8. for double stems requiring a "boring backcut"
  9. communication with "wedgeman"

F. limbing techniques

  1. safety precautions

    a. tensioned and compressed limb areas
    b. "snapper" poles
    c. use of hands to remove limbs
    d. top lopping

G. bucking techniques

  1. use of the wedge
  2. safety precautions
  3. bucking for top bind
  4. bucking for bottom bind
  5. bucking for end bind
  6. bucking for grade

VI. Log scaling practices

  A. definition of the scaling cylinder
  B. natural and man-made defects
  C. measurement standards for wood practices

    1. trim allowance variation
    2. length measurement
    3. diameter measurement

  D. diameter tape use, log scale stick use, log rule selection

    1. international 1/4 inch
    2. Doyle
    3. Scribner

E. defect deduction methods

  1. for butt rot
  2. for fire scar
  3. for crook
  4. for sweep
  5. for ring shake

F. scaling records

VII. related topics

A. logging road layout and construction
B. methods of marketing the product
C. sawmill operation
D. log and lumber grading

TEACHER ACTIVITIES:

1. Lecture time will be utilized to introduce students to forest products and occupational opportunity.

2. Demonstration of writing timber sales contracts, utilizing log scale sticks, interpreting log rules and log defects shall be presented.

3. Chain saw parts should be provided for student observation.

4. Field labs to provide felling experience, exposure to various logging jobs in progress, and sawmill activities should be organized.

5. Demonstrate felling, limbing and bucking techniques.

6. Demonstrate chain saw maintenance and operation.

STUDENT ACTIVITIES:

1. Retain notes of lecture and reading activities.

2. Answer questions provided in work manuals as well as abstract information from magazine articles related to production activities.

3. Perform all routine maintenance tasks related to chain saws.

4. Determine board foot content in standing trees and logs, using required tools and accepted rules.

5. Perform and repeat skills in chain saw operation, felling, limbing and bucking.

6. Write timber sales agreements.

7. Discuss and compare differences, similarities, advantages, and disadvantages with respect to various harvesting systems.

EVALUATION:

1. Quizzes, tests and question review from manuals.

2. Observe students performance in chain saw maintenance. Check for correct use of tools and proper adjustment of saws.

3. Evaluate procedures of felling, limbing and bucking from the standpoint of safety and efficiency.

4. Evaluate accuracy for log measurements for volume.

5. Check students for correctness of proportions and angles (gas/oil ratio, saw chain angles, etc.)

RESOURCES:

1. Regional foresters (private or State)

2. Local wood producers

   A. loggers
   B. sawmill operators

3. Chain saw dealers and repair shops

4. Materials and equipment:

   A. log scale sticks
   B. hard hats
   C. timber chaps
   D. toe guards
   E. ear protection
   F. chain saws (minimum of 14" bar length suggested)
   G. magnesium and plastic wedges
   H. diameter tape
   I. eye protection
   J. single bit axes
   K. Oregon "file 'n joint" unit
   L. saw wrenches, files

M. safety gas cans
N. bar oil containers
O. work gloves
P. chain and bar samples, sprocket samples
Q. bar oil, regular gas, correct two cycle oil blend

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1. Bromley, W., Pulpwood Production, Interstate Printers, Danville, IL.

2. Brown, W.H., An Introduction to the Seasoning of Timber, Pergamon Press, NY.

3. Dent, D. Douglas, Professional Timber Felling: A Procedural Approach, Ryder Printing Co., Portland Oregon.

4. Desch, Timber: Its Structure and Properties, MacMillan Co., NY.

5. Dilworth, J.R., Log Scaling and Timber Cruising, Oregon State University Press.

6. Forbes, R.D., Forestry Handbook, Ronald Press, NY.

7. Ludstrum, S., Circular Sawmills, United States Department of Agriculture.

8. Oregon Saw Chain Manual, Courtesy of Omark Industries.

9. Products From Our Forests, Their Manufacture and use, Penn. State University, Department of Agricultural Education.

10. Chain Saw Technician Workbook, Automated Teaching Systems by Ken Cook Transnational, Milwaukee, Wisconsin.

MEDIA:

1. Transparency masters for production forestry available from Vocational Instructional Services, Agricultural Education, Texas A & M University, College Station, Texas.

2. Safety films re: chain saw operation and skidder/logging safety from Caterpillar Tractor and Homelike through Modern Talking Picture Service.

3. Slide set on hardwood log and lumber grading form Instructional Materials Services: Cornell University, Ithaca, NY.

NATURAL RESOURCES CURRICULUM

UNIT: Forest Measurements

LENGTH: 3 Weeks

WHEN TAUGHT: Grade 11 or 12, Fall, Winter or Spring

OBJECTIVES: The student will be able to:

1. identify and explain the type or types of legal surveys used in his state or region with accuracy specified by the instructor.
2. obtain distance on level ground (less than 2% slope) by pacing with less than 2% variation in 100 feet and by chaining with a steel tape and chaining pins with an allowable error of .02%.
3. obtain distance on sloping ground (over 2%) by pacing with less than 4% variation and by breaking chain using a steel tape and chaining pins with an allowable error of one foot in 500 feet.
4. establish predetermined angles or bearings using a surveyor's staff compass to within one degree.
5. run an open traverse and a closed traverse in the field using a staff compass, steel tape and chaining pins with the closed traverse to close within one foot in 500 feet of distance.
6. determine the land area, within one acre per twenty acres, of area having triangular, rectangular, trapezoidal, trapezium or curved boundaries using land measurements and set formulas.
7. use one or more of the following measures of forest products to determine the volume of wood in a specified number of logs or bolts with accuracy required of a forestry aide: linear measurement, cordwood measurement, cubic foot measurement, board foot measurement, and weight.
8. using common tree measurement instruments and tree volume tables, determine the volume of timber in a standing tree within +/- 3%.
9. using tree identification keys and an increment borer or increment hammer, determine the species, age and/or history of a standing tree with accuracy required of a forestry aide.
10. when given commonly used surveying instruments, locate and establish forest boundaries and sample plots with the accuracy needed to perform a timber cruise.
11. identify and implement the different methods of cruising timber with competency required of a forest aide.
12. using state or regional price data, estimate the value of a given stand of timber within +/- 10%.

13. using a sprayer or brush and bucket, mark trees for harvesting using marking techniques accepted in the state or region.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Forestry Technician	483-484 (1a, 3)
Surveyor's Apprentice	487-489
Land Use Planning Technician	490-492 (1a, b, 3a, d, e)
Forestry Aide	540 (1, 2)
Wood Producer	550-551 (1e-p)
Sawyer	557 (6)
Forest Insect Ranger	570 (2)
Christmas Tree Farmer	578 (1i, 6)

CONTENT:

I. Identifying types of public land surveys

  A. using the metes and bounds system
  B. using the rectangular system
  C. interpreting deeds and legal descriptions

II. Making linear measurements on level ground

  A. pacing
  B. chaining

    1. identifying units of measure
    2. identifying the equipment and its proper use
    3. caring for the equipment
    4. recording field notes

III. Making linear measurements on sloping ground

  A. pacing
  B. breaking chain

IV. Establishing angles and bearings with a staff compass

  A. transporting the instrument safely
  B. setting up the instrument
  C. reading the compass
  D. allowing for angle of declination

V. Running open and closed traverses

  A. establishing angles
  B. chaining

VI. Determining acreage in land areas

- A. measuring boundaries
- B. making calculations

VII. Measuring forest products

- A. using board feet
  - 1. determining circumstances of use
  - 2. using formulas to calculate board feet
- B. using cubic feet
  - 1. determining circumstances of use
  - 2. calculating cubic feet
- C. using the cord
  - 1. identifying different types of cord measurement
    - a. standard
    - b. long
    - c. short
  - 2. determining circumstances of use
  - 3. calculating cords
- D. using unit or piece measure
- E. using weight measure

VIII. Determining the volume of timber in a standing tree

- A. determining the diameter breast height (DBH)
- B. determining the height and number of logs in the tree
- C. observing tree defects of damage
- D. using tree volume tables
  - 1. international
  - 2. Doyle
  - 3. Scribner
  - 4. other

IX. Determining the species, history and/or age of a tree

- A. identifying tree species
- B. interpreting annual rings
- C. using the increment borer or hammer

X. Determining the "Site Quality Index" of a given site

- A. determining species
- B. determining height of a tree
- C. determining D.G.H. and obtaining increment borer sample
- D. interpreting site quality index

XI. Establishing forest boundaries and location of sample plots

- A. identifying characteristics of metes and bounds and rectangular survey systems
- B. operating forest surveying equipment

    1. staff compass
    2. chain and chaining pins
    3. Abney hand level

- C. interpreting maps and aerial photographs

XII. Cruising timber

- A. implementing the different methods of cruising timber

    1. making a 100% or total cruise
    2. using the random sample method
    3. using mechanical sampling methods

        - a. line-plot cruising
        - b. strip cruising

    4. using the variable plot method

        - a. using a wedge prism
        - b. computing the basal area in square feet per acre

- B. making a continuous forest inventory

    1. locating the sample plot
    2. collecting data

XIII. Estimating the timber value of a forest area

- A. reading timber price data
- B. calculating timber value

XIV. Marking trees for harvesting

- A. using correct symbols
- B. selecting trees for marking
- C. operating and maintaining the equipment

TEACHER ACTIVITIES:

1. Arrange to have local service forester speak to students about forest measurements, tree identification and growth.
2. Arrange a field trip to a local forest presently being surveyed and/or cruised. Have students assess if possible.
3. Demonstrate the use of and care of all equipment.

STUDENT ACTIVITIES:

1. Determine the type of legal survey used in their state or region and practice locating specified sites or land areas from deeds or land descriptions. Visit a local town clerk's office.
2. Chain a 100 foot distance on level ground, determine the number of paces needed to pace the distance, and calculate the length of each pace.
3. Chain and pace a specified distance on sloping ground to determine the effects of slope on length of pace.
4. Take a point on a topographic map and select a destination point. Attach strings from the starting point along a true north direction and a magnetic north direction. Calculate the distance by which they would have missed the destination by following the magnetic north without allowing for angle of declination.
5. Have pair of students run closed traversed in the field using the necessary equipment. Have a soil conservation service aide or technician assist in instructing the students if necessary.
6. Practice determining acreages by running closed traverses and calculating the acreage from the results.
7. Given the measurements of standing trees, logs, or boards, calculate the board feet, cubic feet and/or linear feet in the material.
8. Practice determining the volume of wood present, in an assigned number of trees or a plot in a forested area.

9. With the assistance of a service forester or a forest industry representative, identify tree species, using the increment borer and interpreting cores taken from trees.

10. Take a field trip to a forested area that is being surveyed to establish legal forest boundaries and/or to locate sample plots for cruising. Observe the procedures and assist, if possible.

11. Perform a total cruise on a given forest plot to develop abilities in identifying trees, determining tree volumes and reading volume tables.

12. From the cruise made in learning activity #5, compute the value of the timber using regional price data.

13. Use the service forester as a resource person to demonstrate the proper methods and symbols to use in marking trees for harvesting.

EVALUATION:

1. Have each student write a description of the basic types of legal surveys.

2. Have each student measure distances by pacing ground. Evaluate the students by chaining the same distances with accuracy to be within limits set in the performance objectives.

3. Have each student measure distances by pacing on sloping ground. Evaluation should be in accordance with the limits set in the performance objectives.

4. Have each student establish angles using a transit or staff compass with accuracy to be within one degree of the specified angle.

5. Have pairs of students run a closed traverse using a transit or staff compass, steel tape and chaining pins with accuracy within one foot in 500 feet of distance.

6. Determine the land area in acres of regularly and irregularly shaped land areas by making all necessary measurements needed for calculation and using set formulas.

7. Assign the students 10 to 15 trees to determine the volume, using a cruiser stick and tree volume tables. The student should be accurate with +/- 10%.

8. Have the students interpret the rings from a core taken from a tree with an increment borer. The students should indicate the tree's age and any major historical features that could be observed on the core.

9. Divide the students in pairs. Have each pair of students establish the boundaries of a sample plot in a forested area using the necessary surveying equipment. Evaluate the students on accuracy and correctness of procedure. Obtain aid in evaluation from a service forester, forest industry representative or soil conservation service representative, if necessary.

10. Have the class cruise a forested area using one of the basic methods. Evaluate each student on his correctness of procedure, accuracy, and cooperation. The accuracy of the cruise can be checked if the area has recently been officially cruised.

11. Have each student calculate the total value of a forested area when given the results of a timber cruise and regional price data.

12. Have each student list the different marks or symbols used for marking trees and explain their meanings.

RESOURCES:

1. Staff compass
2. Steel tape and chaining pins
3. Hand compass
4. Field notebook
5. Deeds or legal land descriptions
6. Hard hats
7. Cruiser sticks
8. Staff compass
9. Abney level and/or clindmeter
10. Increment borer and/or hammer

11. Timber volume tables
12. Site Quality Index graphs
13. Regional timber price data
14. Tree identification keys
15. Talley sheets
16. Paint sprayer or bucket and brush
17. Tree diameter tapes and/or calipers
18. 10 factor pri.

BIBLIOGRAPHY:

1. Allen, Shirley W., and Sharpe, Grant W., An Introduction to American Forestry, McGraw-Hill Book Company, New York, NY., 1960.
2. Avery, T. Eugene, Interpretation of Aerial Photographs, Burgess Publishing Co., Minneapolis, MN., 1968.
3. Bell, J.F. and Dilworth, J.R., Variable Probability Sampling, O.S.U. Book Stores, Inc., Corvallis, Oregon, 1976.
4. Brinker, R.C. and Taylor, W.C., Elementary Surveying, International Textbook Co., Scranton, PA., 1965.
5. Conservation Aide IV - Surveying, Ohio Agricultural Education Curriculum Materials Service, Columbus, OH, The Ohio State University, 1972.
6. Dilwroth, J.R., Log Scaling and Timber Cruising, O.S.U. Book Stors, Inc., Corvallis, Oregon, 1976.
7. Forbes, R.D., Forestry Handbook, The Ronald Press Co., New York, NY.
8. Harvesting Forestry Products, Vocational Instructional Services, Texas State Department of Education, Kirbyville, TX., 1971.
9. National Forest Log Scaling Handbook, Forest Service, U.S. Department of Agriculture, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. (stock # 0101-00364).

10. Rast, E.D., Sonderman, D.L., Gammon, G.L., A Guide to Hardwood Log Grading, U.S.D.A. Forest Service, General Technical Report NE-1, 1973.

11. Schwab, Glenn O., Frevert, Richard K., Barnes, Kenneth K., and Edminster, Talcott W., Elementary Soil and Water Engineering, John Wiley & Sons, Inc., new York, NY., 1965.

12. Sipe, F. Henry, Compass Land Surveying, McClain Printing Co., Parsons, West Virginia, 1974.

13. Timber Cruising Workshop, (hand-out), Six State Conference, Essex Agricultural & Technical Institute, 1977.

NATURAL RESOURCES CURRICULUM

UNIT: Forest Products

LENGTH: 3 Weeks

WHEN TAUGHT: Grade 11 or 12, anytime

OBJECTIVES: The student will be able to:

1. list the important timber species of Connecticut and the types of products manufactured from them.
2. describe the basic structure and properties of wood.
3. explain what properties cause differences in value and use of woods.
4. correctly identify wood samples as assigned.
5. describe the basic principles behind log and lumber grading.
6. scale and grade logs.
7. describe career opportunities in the forest products field.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Forest Technician	484 (4f)
Sawyer	556-558
Sawmill Operator	559-564
Christmas Tree Farmer	578-581
Maple Syrup Producer	582-584

CONTENT:

I. Identifying timber species in Connecticut

II. Identifying wood products

  A. primary wood products

    1. sawlogs
    2. veneer logs
    3. pulpwood
    4. posts and pilings

5. tie logs and mine timbers
6. specialty products
    a. Christmas trees
    b. maple syrup
    c. witch hazel

B. secondary wood products

1. cooperage
2. pallets
3. veneer and plywood
4. furniture
5. pulp and wood
6. particle board and flake board
7. boxes and crates

III. Properties and structure of wood

A. characteristics of wood

1. resistance to decay
2. strength
3. versatility
4. workability
5. resiliency
6. resistance to temperature change

B. structure and functions of wood

1. bark
2. cambium
3. vessels and rays
4. fibers
5. heartwood and sapwood

IV. Identification of wood samples

V. Log scaling

A. length
B. trim allowance
C. diameter at small end
D. defects
E. volume determination

VI. Wood Processing

A. sawmills

1. types of mills
2. circular saws
3. band saws

B. sawing process

C. types of cuts and uses

1. end cut
2. radial cut
3. tangential cut

VII. Career opportunities

TEACHER ACTIVITIES:

1. Arrange field trips to different types of sawmill operations.

2. Request log grader to assist students in learning to grade logs.

STUDENT ACTIVITIES:

1. Review tree identification. Collect bark and wood of species to be studied.

2. List types of wood products with which they are familiar.

3. Field trips to see as many different types of mills as is possible and to view product manufacture.

4. Field trip to saw mill to observe and/or assist grader in grading logs.

5. Practical scaling of logs of varying sizes.

6. Field trip to lumber yard to view sales operation.

7. Identify wood samples.

8. Identify wood structure in diagrams and samples.

EVALUATION:

1. State of Connecticut: Primary Processors Forest Products Utilization, Department of Environmental Protection.
2. Local sawmills for field trips.
3. Local foresters.
4. Wood samples.
5. Log scale sticks.
6. Green lumber rule.

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1. Bromley, W.S., Pulpwood Production, The Interstate Printers and Publishers, Inc., Danville, Illinois, 1976.
2. Dilworth, J.R., Log Scaling and Timber Cruising, Oregon State University Book Stores, Inc., 1977.
3. Harlow, William M., Inside Wood: Masterpiece of Nature, The American Forestry Association, 1970.
4. Panshin, A.J., et al, Forest Products Their Sources, Production and Utilization, McGraw-Hill Book Company, New York, 1962.
5. Panshin, A.J. and Carl de Zeeuw, Textbook of Wood Technology,, Vol. I, 3rd. ed., McGraw-Hill Book Company, New York, 1964.
6. Wyman, Edgar P., Growing Christmas Trees in Connecticut, Extension Bulletin #72-20. College of Agriculture and Natural Resources, University of Connecticut, Storrs, Connecticut.
7. Wyman, Edgar P., Planting Forest Trees in Connecticut, Extension Bulletin #72-20. College of Agriculture and Natural Resources, University of Connecticut, Storrs, Connecticut.
8. Various literature is available through the following organizations:

American Wood Council
1619 Massachusetts Ave., NW
Washington, D.C. 20036

American Plywood Association
1119 A Street
Tacoma, Washington 98401

Canadian Wood Council
701-170 Laurier Ave. West
Ottawa, Ontario K1p5V5

Southern Forest Products Assoc.
P.O. Box 52468
New Orleans, Louisiana 70152

Western Wood Product Assoc.
700 Yeon Building
Portland, Oregon 97204

MEDIA:

1. Slide Series: Relationship of Hardwood Log and Lumber Grades, IMS, Cornell.
2. Wood Technology, series of transparencies on wood and wood products, DCA Education Products, Inc., 1969.
3. Maple Syrup Production, filmstrip, available through NASCO.

NATURAL RESOURCES CURRICULUM

UNIT: Forest Protection

LENGTH: 3 Weeks

WHEN TAUGHT: Grade 11 or 12, Fall

OBJECTIVES: The student will be able to:

1. identify major tree diseases in our forest region.
2. select the most appropriate control measure for a given disease.
3. perform the necessary prevention or control procedures to keep disease losses at a minimum.
4. identify major tree insects in our forest region.
5. select the most appropriate control measure for a given insect.
6. perform the necessary prevention or control procedures with accuracy needed to keep insect losses in the forest at a minimum.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Forest Technician	485 (8)
Campground Maintenance Person	505 (8, 9)
Park Aide	506 (2, 3)
Forestry Aide	540 (1c, h, i, k, n)
Forest Insect Ranger	570-571 (3, 4, 5, 6)
Christmas Tree Grower	578-580 (1a, 1, 2a, 3, 4)

CONTENT:

I. Identifying major forest diseases

   A. identifying rot causing fungi
   B. identifying foliage diseases
   C. identifying stem diseases
   D. identifying root diseases

II. Developing disease prevention and control programs

   A. preventing forest diseases
   B. determining disease control methods

III. Determining the role of insects in the forest

- A. determining importance of forest insects
- B. identifying beneficial insects
- C. identifying destructive insects
    - 1. conifer and hardwood defoliators
    - 2. tip, cambium, heartwood and root feeders
    - 3. sap feeders
    - 4. identifying disease vectors
- D. identifying forest insects damage

IV. Selecting insect control methods

- A. determining direct control methods
    - 1. using mechanical methods
    - 2. using chemical methods
- B. determining indirect control methods
    - 1. using silvicultural practices
    - 2. using indirect biological and chemical controls
- C. determining forest insect control regulations

V. Identifying other destructive agents

- A. determining the effects of forest animals
- B. determining the effects of man
- C. determining the effects of natural phenomena

TEACHER ACTIVITIES:

1. Organize a field trip for observation and collection of samples.

2. "Dissect" a tree with a chain saw to show visible signs of disease and decay.

3. Organize field trips to forests/plantations exhibiting protective measures to prevent damage to trees by insects, diseases, man, animals and/or climatic factors.

STUDENT ACTIVITIES:

1. Make field observations of trees to show visible signs and symptoms of decay.

2. Develop a disease prevention program for a given forested area.

3. Locate, capture and identify forest insect pests.

4. Sketch damage caused to forest trees from insects and diseases.

5. Prepare a report on one major forest insect and disease to be given in class. Each student will be required to fill out a work sheet on each insect and disease.

6. If an insect infested area is available, have students perform mechanical or chemical measures to help control insect damages.

EVALUATION:

1. Rate students' collection and identification of 35 insects of insect damaged parts. The following information is to be known: common name, order, identification feature, plants damaged or beneficial results, economic importance, control and type of metamorphosis.

2. Rate presentation of information on important forest insects.

3. Evaluate students' identification of slides of the more common forest diseases.

4. Evaluate plan developed for a given forest area concerning insect and disease control.

RESOURCES:

1. Exterminator in local area.

2. Visit forest experiment station to observe their work with insects.

3. Use extension forester to discuss injury of forests from insects and control methods.

BIBLIOGRAPHY:

1. Anderson, Roger: Forest and Shade Tree Enotomology, John Wiley and Son.

2. Borror and White: A Field Guide to the Insects, Houghton Mifflin Co.

3. Diseases of Shade and Ornamental Trees.

4. Graham, S.A., Knight, F.B.: Principles of Forest Entomology, McGraw Hill.

MEDIA:

1. Films are available from Shell Film Library

   A. "Food or Famine"
   B. "Rural World"

2. Slides depicting signs of insect/disease/animal damage.

NATURAL RESOURCES CURRICULUM

UNIT: Forest Soils

LENGTH: 3 Weeks

WHEN TAUGHT: Grade 11 or 12, early Fall or Spring

OBJECTIVES: The student will be able to:

1. identify the physical and chemical properties of forest soils.
2. identify factors which promote and destroy forest soils.
3. judge land for proper use and maximum protection.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Soil Conservation Aide	515-516 (6, 7, 11, 12)
Soil Conservation Technician	517-519 (1, 2, 3, 4, 9)
Forestry Aide	540 (2)
Christmas Tree Grower	578 (1a, e, f, k, 1, 4)

CONTENT:

I. Development of forest soils
  A. classification of parent materials
  B. type of vegetation
  C. humus production

II. Physical properties
  A. soil texture
  B. soil structure
  C. soil porosity
  D. permeability

III. Chemical properties
  A. soil reactions
  B. essential nutrients for forest growth
  C. toxic agents in runoff areas
  D. mineral deficiencies

IV. Organisms of forest soils

  A. bacteria and fungi
  B. insects
  C. earthworms and nematodes

V. Physical damage to forest soils

  A. compaction and erosion

    1. animal
    2. harvesting equipment

  B. forest fires
  C. overgrazing in range lands

VI. Land use management

  A. land judging

    1. drainage classes
    2. depth favorable to roots
    3. fertility
    4. planting difficulties
    5. access limitations

  B. forest lands as watersheds
  C. planting and reforestation techniques
  D. mapping

    1. topography

TEACHER ACTIVITIES:

1. Use lecture periods to explain forest soils and how they influence tree growth.

2. Demonstrate the procedures for judging land use and if possible use dug pits on land lab.

3. Contact local soil conservation services to plan field trips and aid in land use classification.

4. Contact local town personnel in regards to large equipment (backhoe if available to dig soil pits).

5. Prepare laboratory projects on plant deficiencies and effects of germination on compacted forest soils.

STUDENT ACTIVITIES:

1. Maintain a notebook on lectures and discussions.
2. Answer study questions.
3. Take forest soil samples for class labs.
4. Test their forest samples for water holding capacity, chemical deficiencies, and various physical properties.
5. Evaluate test findings.
6. Develop a notebook on land use classification of local forests near school.

EVALUATION:

1. Review notebooks and homework.
2. Evaluate student learning through quizzes and tests.
3. Have students demonstrate laboratory techniques.
4. Evaluate recommendations of students after testing various forest soils.
5. Evaluate notebook on land use classification.

RESOURCES:

1. Contact local extension office and University of Connecticut for publications.
2. Invite local foresters and soil conservation people to give shop talks and help arrange field trips.
3. Lab and soil testing equipment.

BIBLIOGRAPHY:

1. Forbes, Reginald D., Forestry Handbook, Ronald Press, 1955.
2. USDA, Woodlands of the Northeast, Erosion and Sediment Control Guide.

MEDIA:

1. ______________________________

2. ______________________________

NATURAL RESOURCES CURRICULUM

UNIT: Forest Surveying and Land Measurement

LENGTH: 3 Weeks

WHEN TAUGHT: Grade 11 or 12, Fall or Spring

OBJECTIVES: The student will be able to:

1. identify and explain the type or types of legal surveys used in this state with accuracy specified by the instructor.
2. obtain distance on level ground (less than 2% slope) by pacing with less than 2% variation in 100 feet and by chaining with a steel tape and chaining pins with an allowable error of .02%.
3. obtain distance on sloping ground (over 2%) by pacing with less than 4% variation and by breaking chain using steel tape and chaining pins with an allowable error of one foot in 500 feet.
4. measure angles with the steel tape.
5. establish predetermined angles or bearings using a transit or a surveyor's compass to within one degree.
6. determine the land area, within one acre per twenty acres, of areas having triangular, rectangular, trapezoidal, trapezium or curved boundaries using land measurements and set formulas.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Forestry Technician	483 (1, 2)
Surveyors Apprentice	487-488
Land Use Planning Technician	491-492 (3, 6, 7)
Soil Conservation Technician	518 (2f, g, 3)
Forestry Aide	541 (2)
Wood Producer	550 (1c, j, m)

CONTENT:

I. Identifying types of public land surveys

   A. using the metes and bounds system
   B. using the rectangular system
   C. interpreting deeds and legal descriptions

II. Making linear measurements on level ground

- A. pacing
- B. chaining
    1. identifying units of measure
    2. identifying the equipment and its proper use
    3. caring for the equipment
    4. recording field notes

III. Making linear measurements on sloping ground

- A. pacing
- B. breaking chain

IV. Differential leveling

- A. using the level
    1. transporting instruments safely
    2. setting up the instrument
    3. adjusting the instrument
- B. reading the rod
    1. red numbers - feet
    2. black numbers - inches or tenths of feet
    3. black and white spaces - hundredths of feet

V. Establishing angles and bearings with a transit or compass

- A. transporting the instrument safely
- B. setting up the instrument
- C. reading the compass and vernier

VI. Determining acreage in land areas

- A. measuring boundaries
- B. making calculations

VII. Mapping

TEACHER ACTIVITIES:

1. Demonstrate the use and care of all equipment.

2. Set up surveying courses for student exercise.

STUDENT ACTIVITIES:

1. Determine the type of legal survey used in the state and practice locating specified sites or land areas from deeds or land descriptions.
2. Chain a 100 foot distance on level ground, determine the number of paces needed to pace the distance, and calculate the length of each pace.
3. Chain and pace a specified distance on sloping ground to determine the effects of slope on length of pace.
4. Practice reading the Philadelphia rod.
5. Do a differential leveling exercise on a predetermined course.
6. Map their work to practice mapping skills, especially the use of scales.

EVALUATION:

1. Evaluate students' description of the basic types of legal surveys.
2. Have each student measure distances by pacing ground. Evaluate the students by chaining the same distances with accuracy to be within limits set in the performance objectives.
3. Have each student measure distances by pacing on sloping ground. Evaluation should be in accordance with the limits set in the performance objectives.
4. Have each student establish angles using a transit or compass with accuracy to e within one degree of the specified angle.
5. Rate students' solution to a differential leveling problem.
6. Rate students' ability to determine the land area in acres of regularly and irregularly shaped land areas by making all necessary measurements needed for calculation and using set formulas.

RESOURCES:

1. Transit and rod or a staff compass.
2. Steel tape and chaining pins or gunter's chain.
3. Hand compass.
4. Field notebooks.
5. Deeds or legal land descriptions.
6. Level.
7. Rod.

BIBLIOGRAPHY:

1. Conservation Aide IV - Surveying, Ohio Agricultural Education Curriculum Materials Service, The Ohio State University, Columbus, Ohio, 1972.
2. Davis, S., Elementary Plane Surveying, McGraw-Hill, 1960.
3. Forbes, R.D., Forestry Handbook, Ronald Press, 1955.
4. Schwab, Glenn O., Frevert, Richard K., Barnes, Kenneth K., and Edminster, Talcott W., Elementary Soil and Water Engineering, John Wiley and Sons, New York, New York, 1965.

MEDIA:

1. VEP filmstrips, Cal-Poly:

   "Use of the level: Setting up the Instrument"
   "Use of the level: Reading the Rod"
   "An Exercise in Differential Leveling"

NATURAL RESOURCES CURRICULUM

UNIT: Gamebird Propagation

LENGTH: 3 Weeks

WHEN TAUGHT: Grade 11 or 12, Fall

OBJECTIVES: The student will be able to:

1. identify and select gamebird species to propagate that an economic evaluation indicates would be profitable.
2. given the species and desired number of birds to be propagated, develop a breeding, reproduction, and incubation program that will produce gamebirds with less than 10% loss.
3. carry out a plan for brooding a designated species of gamebirds which will result in a minimum loss of birds.
4. develop a feeding system and balance rations for a given lot of growing birds and breeders which will maximize gains per pound of feed and minimize waste.
5. prescribe and implement a plan for preventing and/or curing common diseases and parasites which afflict gamebirds.
6. using special crates and catching nets, handle and transport gamebirds in a manner which will prevent injury and feather loss.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Game Farmer	531-534

CONTENT:

I. Selecting the species to propagate

- A. identifying gamebird species and characteristics
- B. determining sources of eggs or chicks
- C. determining market demand
- D. evaluating costs and returns
    1. fixed costs
    2. variable costs
    3. gross returns
    4. net returns

II. Breeding and reproduction methods

A. identifying the parts of the reproductive system of male and female birds
B. identifying mating systems

1. purposes of outbreeding
2. purposes of inbreeding
3. purposes of crossbreeding
4. purposes of line breeding

C. incubating gamebird eggs

1. controlling light
2. controlling heat
3. controlling humidity

III. Brooding and rearing gamebirds

A. selecting the housing and equipment

1. determining the types and sizes of housing needed
2. selecting the ventilation system
3. determining insulation requirements
4. selecting the lighting, watering and feeding systems
5. maintaining the housing and equipment

B. managing the brooder

1. determining temperature requirements
2. determining floor and water space requirements
3. determining litter requirement
4. developing the feeding system

IV. Feeding gamebirds

A. identifying the digestive system parts and their functions
B. identifying the six classes of nutrients, their functions and sources
C. identifying gamebird nutrient requirements

1. chicks
2. growing poults
3. breeders

D. formulating rations

1. determining availability and costs of feeds
2. determining nutritional value
3. determining palatability and ease of feeding

V. Controlling diseases

- A. identifying and controlling contagious and non-contagious infectious diseases
    - 1. recognizing symptoms
    - 2. determining causes
    - 3. identifying prevention techniques
    - 4. prescribing treatment and control
- B. identifying non-infectious diseases
    - 1. identifying nutritional diseases
        - a. recognizing symptoms
        - b. determining causes
        - c. identifying prevention techniques
        - d. prescribing treatment
    - 2. identifying traumas
    - 3. identifying inherited diseases and defects
- C. identifying and controlling parasites
    - 1. identifying internal parasites
        - a. recognizing the symptoms
        - b. determining prevention techniques
        - c. prescribing treatment and control
    - 2. identifying external parasites
        - a. recognizing the symptoms
        - b. determining prevention techniques
        - c. prescribing treatment and control
- D. maintaining sanitation
    - 1. controlling moisture
    - 2. disinfecting
    - 3. maintaining proper litter

VI. Handling and transporting gamebirds

- A. catching the birds
- B. handling birds
- C. protecting birds during transportation

TEACHER ACTIVITIES:

1. Have available slides, mounts, pictures and books to aid students in bird identification.
2. Demonstrate proper dissection technique.
3. Arrange field trips to local game farms to observe facilities.
4. Contact a resource person to explain disease symptoms and to direct post mortum examinations by students.
5. Arrange with the Department of Environmental Protection to release pen raised birds.

STUDENT ACTIVITIES:

1. Use slides, mounts, movies and field trips for gamebird identification.
2. Dissect a male and female bird; draw and label the parts.
3. Hatch gamebird eggs in the classroom with an incubator and raise the birds on the school land laboratory or on a class member's land.
4. Take a field trip to game farms to observe facilities used for brooding and rearing gamebirds.
5. Dissect a bird's digestive system and draw and label the parts.
6. Practice formulating rations for chicks and growing poults.
7. Use a resource person to explain disease symptoms in live birds and assist the students in performing a post-mortum examination.
8. Release the gamebirds produced in a previous activity when they are of appropriate maturity under supervision of conservation officer.

EVALUATION:

1. Have each student prepare a budget for raising a selected species and number of gamebirds from incubation to market. The budget should contain fixed and variable costs as well as gross and net returns.

2. Have the students identify the parts of the male and female reproductive systems of gamebirds on diagrams prepared by the teacher.

3. Specify a species and number of gamebirds for which the students are to indicate the housing requirements, space requirements, and other environmental conditions that would be needed to promote the birds' health and vigor.

4. Have the students develop a suitable ration for a species of gamebirds at a designated age. The ration should be evaluated as to its nutritional value, cost, and palatability.

5. Develop a matching test in which the students will match common gamebird diseases with their cause, vector, prevention methods or cure.

6. Have the students list the safety precautions they should use when handling and transporting gamebirds to prevent injury or feather loss.

RESOURCES:

1. Refrigerator.
2. Dissecting trays and kits.
3. Tissue forceps.
4. Thumb forceps.
5. Wire mesh strainers.
6. Rubber aprons.
7. Demonstration incubator brooder.
8. Housing, pens, and equipment for raising gamebirds.

BIBLIOGRAPHY:

1. Catalog of Game Breeding Information, current edition, National Shooting Sports Foundation, Riverside, CA.
2. Managing Gamebirds, Bulletin No. 3-692, Michigan State University Extension Service, East Lansing, Michigan, 1972.
3. Sheid, Dan W., Raising Game Birds, NASCO.

MEDIA:

1. Gamebird Management, 2 part filmstrip depicts management of pen reared and wild birds. Available from Vocational Education Productions.

NATURAL RESOURCES CURRICULUM

UNIT: Introductory Taxidermy (Fish)

LENGTH: 3 Weeks

WHEN TAUGHT: Grade 11 or 12, November, December

OBJECTIVES: The student will be able to:

1. prepare fish specimens as live mounts using techniques of plaster cast molding.
2. perform plastic and/or resin casting and cast cleaning.
3. finish and paint mounts.
4. mount specimen on wall

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Commercial Fisherman	497 (5)
Hunting and Fishing Guide	513 (10)
Conservation Officer	530 (13)

CONTENT:

- I. Determination of the relationship of taxidermy to natural resources occupations
  - A. types of applications
    - 1. museum taxidermy
    - 2. trophy taxidermy
    - 3. novelty taxidermy
  - B. experience required
  - C. economic potential
  - D. skills required for proficiency
- II. Skills development
  - A. preliminary preparation of fish
    - 1. color photographs from different angles with repeats
    - 2. sketch and notes of body coloration
    - 3. skin protection of freshly caught fish
    - 4. freezer wrapping, freezer placement

B. preparing fish molds

1. selection of molding plaster grade
2. mixing technique for molding plaster
3. preparing fish for molding plaster
    a. slime removal
    b. skin tightening
    c. show side selection
    d. pectoral and ventral fin removal
    e. belly contouring
    f. shelf building
    g. body positioning
    h. mouth molding

4. plaster application
    a. first layer technique
    b. second layer reinforcement
    c. second layer application/reversal and backside layer application
    d. fin molding
    e. separating mold halves

5. preparing plaster mold for resin casting
    a. shellac application for pinhole detection
    b. shellac/alcohol mix application(s) to reduce porosity
    c. backside mold half preparation
        i. fin mold removal (dorsal and anal fins)
        ii. back "cutaway" for mounting board
    d. mixing and applying "separator" to mold
    e. selecting and mixing proportions of catalyst and resin

6. application of the resin
    a. first application technique
        i. powdered glass mixture
        ii. thickened paste
    b. second application technique
        i. fiberglass or equivalent cloth application
        ii. liquid consistency

    - c. separation of finished casts from mold
    - d. trimming cast excess, filling imperfections
    - e. attaching halves together
    - f. filling imperfections along seam line/cutting excess

7. fin attachment, glass eye replacement
8. body painting
    - a. paint type and selection
    - b. base paint applications
    - c. body painting techniques
        - i. oil paint blending
        - ii. finish spray overcoating

TEACHER ACTIVITIES:

1. Arrange a field trip to a local museum for students to view different types of live mount specimens.

2. Demonstrate skills in preparing fish and fish molds, resin casting fin attachment, eye placement and body painting.

3. Acquire enough specimens for class use.

STUDENT ACTIVITIES:

1. Locate local taxidermists, museums, and novelty shops.

2. Speak with local taxidermist.

3. Prepare fish specimen for plaster, mix plaster, prepare sand box, pour and reinforce plaster.

4. Prepare plaster molds for resin, mix and apply resins, attach both halves and perform finishing techniques for mounting.

5. Perform research on illustrations and photographs from books and magazines.

6. Use assorted tools for shaping and molding.

7. Research the going rate for live mount specimens.

EVALUATION:

1. Have student demonstrate skills needed to make a plaster mold of acceptable quality.
2. Have student list all of the tools and supplies needed to perform a "resin cast taxidermy operation".
3. Student should describe the method of making a "resin cast" duplicate of a fish specimen.
4. Student should construct a "resin cast" duplicate. Evaluation should be made of each phase of the construction: mold, cast, cast finishing and cast painting.

RESOURCES:

1. Peabody Museum, Yale University, New Haven, Connecticut.
2. Taxidermists local to the area.
3. J.W. Elwood Supply Co., Inc. (Taxidermists' supplies), 1202 Harney, Box 3507, Omaha, Nebraska, 68103.
4. Herters', Inc., Mitchell, South Dakota.
5. Marine supply center, (for items such as epoxy resin, plaster of paris, etc.)
6. Supplies needed:

glycerine
epoxy resin
plaster of paris: artist grade
isopropyl alcohol
sand: fine
electric drill
powdered alum
newspaper
spray paints: white and
silver base paints, pearl
matte, clear spray plastic
fresh or frozen fish specimens
(1 1/2 pounds or more)

beeswax
vaseline
parafin
shellac
files, sandpaper (fine)
grinding bits
vinegar
dental picks
brushes
cups for resin and paint
fiberglass cloth
artists oil paints
paint thinner
artist's Japan drier

BIBLIOGRAPHY:

1. Cappel, Leo J., A Guide to Model Making and Taxidermy, A.H. and A.W. Reed, London, England.
2. Herters Guide to Modern Taxidermy, Herters, Inc., Mitchell, South Dakota.
3. McClane, A.J., The Fisherman's Encyclopedia.
4. Migdalski, Edward C., How to Make Fish Mounts and Other Fish Trophies, Ronald Press, New York, New York, 1960.

NATURAL RESOURCES CURRICULUM

UNIT:	Outdoor First Aid
LENGTH:	3 Weeks
WHEN TAUGHT:	Fall, Winter, or Spring - Grades 11, 12

OBJECTIVES: The student will be able to:

1. identify the importance, scope and limitations of first aid in treating accident victims in agricultural resources occupations. The effects of personal injuries to persons employed in agricultural occupations, especially those working in remote areas, can be minimized with the use of proper first aid techniques and compliance with safety procedures.

2. use the following first aid techniques in simulated situations with competency indicated in the First Aid Textbook:

   A. treating wounds
   B. treating sprains and fractures
   C. treating for shock
   D. treating poisoning
   E. treating poisonous bites and plant poisoning
   F. treating burns
   G. administering artificial respiration
   H. transporting injured persons

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Commercial Fisherman	497 (5, 6)
Campground Manager	502 (6)
Campground Maintenance Person	505 (11)
Park Maintenance Person	509 (2)
Hunting and Fishing Guide	513 (7)
Sawyer	556 (2)
Sawmill Worker	559
Forest Fire Ranger	565 (3)
Forest Fire Fighter	568 (6)
Fire Warden	572 (1, 8)
Forest Fire Suppression Crew Leader	576 (3, 4)

CONTENT:

I. Determining the Scope of First Aid

- A. identifying agricultural resources occupations requiring first aid skills
- B. identifying types of first aid skills needed in agricultural resources occupations
- C. identifying the limitations of first aid
- D. identifying individual responsibility and liability
- E. identifying safety procedures needed in specialized areas of agricultural resource occupations.

II. Using First Aid Techniques

- A. treating wounds
    1. identifying type of wound
    2. identifying and using first aid methods
- B. treating sprains and fractures
    1. identifying symptoms
    2. identifying and using first aid methods
- C. treating for shock
    1. identifying signs and symptoms
    2. identifying causes
    3. identifying and using first aid methods
- D. treating burns
    1. using first aid on thermal burns
    2. using first aid on chemical burns
    3. treating sunburn and excessive heat problems
    4. treating excessive cold problems
- E. treating poisoning
    1. common chemical poisons and their effects
    2. identifying signs and symptoms
    3. administering first aid
- F. treating poisonous bites and plant poisoning
    1. identifying the cause of the poisoning
        - a. identifying poisonous snakes in the region
        - b. identifying poisonous arachnids and insects
        - c. identifying poisonous plants
    2. administering first aid

G. using artificial respiration and cardiopulmonary resuscitation

  1. determining conditions when artificial respiration and cardiopulmonary resuscitation is needed
  2. administering artificial respiration and cardiopulmonary resuscitation

H. transporting injured persons

  1. identifying situations requiring movement of patients
  2. preparing the patient
  3. identifying method of transfer

TEACHER ACTIVITIES:

1. Instructor will contact persons involved in Agricultural Resources occupations to discuss the first aid requirements in their occupations.

2. Instructor will set up simulated wounds for students to practice first aid skills.

3. Instructor will contact representatives of local Red Cross chapter, hospital or emergency services as resource persons to demonstrate first aid equipment, supplies and techniques.

STUDENT ACTIVITIES:

1. Set up simulated wounds using students as patients and have others administer first aid.

2. Practice using different methods of artificial respiration with students simulating patients.

3. Have the student practice using an approved first aid snake bite kit under simulated situations.

4. Have students find the names and addresses of area emergency services, poison treatment centers, etc.

5. Have students prepare a bulletin board showing poisonous and non-poisonous snakes, spiders and insects common to the area.

EVALUATION:

1. Have the students list five agricultural resources occupations and at least four first aid requirements for each occupation.
2. Have each student demonstrate at least four first aid skills assigned by the teacher. Evaluate the students as to correctness of procedure.
3. If the teacher is a certified instructor, give the test for certification in CPR and/or basic first aid.

RESOURCES:

1. First aid kits.
2. Snake bite kits.

BIBLIOGRAPHY:

1. Collins, Henry Hill, Jr., Complete Field Guide To American Wildlife, New York, New York: Harper and Rowe Publishers, Inc., 1959, 683 pages.

   This text contains information and color pictures of the poisonous snakes found in the United States.

2. First Aid Textbook, Washington, D.C.: The American National Red Cross, 1977, 268 pages.

   This text will be a valuable reference for the teacher and student while learning and practicing first aid techniques.

3. Grant, Harvey and Murray, Robert, Emergency Care, Bowie, Maryland; Robert J. Brady Co., 1978, 546 pages.

   Excellent manual used in the training of Emergency Medical Technicians.

MEDIA:

1. If you are a certified American National Red Cross instructor, you will have access to all of their training films and materials.
2. "By Nature's Rules": A film on hypothermia, Jim Lawless Motion Picture Consultants, Inc., 1545 N.E. 130th Street, Seattle, Washington, 98125.

NATURAL RESOURCES CURRICULUM

UNIT: Recreation

LENGTH: 3 Weeks

WHEN TAUGHT: Grade 11 or 12, anytime of year

OBJECTIVES: The student will be able to:

1. using federal, state or local data, identify the demands by the public for different types of outdoor recreation experiences in the student's region.
2. prepare a long-range development plan (5-10 years) for a selected enterprise considering initial and additional developments and management requirements.
3. using cost and return data from similar enterprises, prepare a budget for a designated enterprise which would include fixed costs, variable costs, gross returns, net returns and labor management income.
4. when given a specific site and enterprises to be established, prepare a short-term development plan which would include construction, advertising and initial management needs.
5. using federal, state and local codes and regulations, identify laws pertaining to a designated outdoor recreation enterprises including hunting and fishing laws.
6. using the different media, develop a complete public relations program for a given outdoor recreation enterprise.
7. select an appropriate site for a camping area with regard to physical and socioeconomic factors which will contribute to enterprise success.
8. select supplemental enterprises for a camping area which would be most profitable.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Forestry Technician	485 (10)
Surveyor's Apprentice	488 (7)
Land Use Planning Technician	490-492 (1, 2, 4)
Zoning Compliance Officer	493 (1)
Campground Manager	501-502 (2, 8)
Hunting and Fishing Guide	511-513 (1, 2, 3, 9)

CONTENT:

- I. Evaluating the demand for outdoor recreation
- II. Selecting additional outdoor recreation enterprises for a community
  - A. inventorying current enterprises
- III. Analyzing the site potential
  - A. inventorying the natural resources
    - 1. water
    - 2. existing vegetation
    - 3. land area
    - 4. drainage
    - 5. soil
    - 6. topography
- IV. Analyzing the accessibility to the area
  - A. roads
  - B. services
- V. Selecting the type of recreation enterprise for a designated site
  - A. determining alternative site development possibilities
    - 1. matching enterprise requirements with site characteristics
    - 2. determining local area factors
    - 3. determining community acceptance
    - 4. identifying owner/operator management abilities and objectives
    - 5. determining the demand for the alternative enterprise
- VI. Planning the selected enterprise
  - A. preparing a long-range development plan
  - B. preparing the cost-return estimate
    - 1. determining investment and fixed costs
    - 2. determining operating costs
    - 3. identifying gross and net returns
    - 4. calculating labor and management income

VII. Preparing and implementing the short-term development plan

   A. identifying initial construction needs
   B. determining publicity needs
   C. investigating insurance needs

VIII. Determining available financial and technical assistance

   A. identifying federal assistance programs
   B. identifying state and local government assistance programs
   C. identifying sources of private assistance

IX. Determining insurance program needs

   A. identifying kinds of insurance needs
   B. determining amounts of insurance needs
   C. identifying sources of insurance

X. Developing the public relations program

   A. selecting the media to use
   B. determining the amount of public relations needed
   C. developing public relations material

XI. Selecting the type of camping enterprises to establish

   A. determining investment costs
   B. identifying management skills and time required

XII. Selecting a site for a camping area

   A. determining physical factors

      1. identifying water resources
      2. identifying topographical factors and natural attractions
      3. evaluating vegetative factors

   B. determining socioeconomic factors

      1. evaluating geographical location
      2. determining economic and business management factors

XIII. Laying out the camping area

   A. locating campsites and facilities
   B. developing road network
   C. locating improvements

XIV. Providing for sanitation and safety

- A. developing and maintaining the water supplies
- B. developing and maintaining the sanitation system
- C. developing and maintaining the electrical system
- D. controlling insects and pests
- E. outlining safety procedures for running and maintaining tools and equipment

XV. Developing supplemental enterprises

- A. stores and concessions
- B. rentals

TEACHER ACTIVITIES:

1. Organize field trips to local, state, municipal and/or private recreation areas, have students interview owners/managers.

2. Contact local park administrators to determine needs to be approached by students.

STUDENT ACTIVITIES:

1. Inventory present at outdoor recreation enterprises in the community.

2. Take a field trip to existing outdoor recreation.

3. Develop a plan for a selected outdoor recreation enterprise using a selected site.

4. Develop advertising program for a given enterprise. In developing the advertising, each student should develop a brochure and write one item of advertising copy.

5. For a designated outdoor recreation area, develop the insurance needs that would apply to enterprise.

6. Determine the source of financial assistance that may be required to develop the outdoor recreation plan.

7. Consult with State personnel to determine needs of public areas.

8. Take state or municipal specifications and construct picnic tables, grills or signs for a local park or forest.

EVALUATION:

1. Each student will present their recreational inventory of the community.
2. Each student will present a plan for campground development regarding an assigned piece of land.
3. Evaluate the completed advertising brochure.
4. Evaluate the student's financial plan for starting a commercial campground.

RESOURCES:

1. Visit state parks and private campgrounds to determine differences in services offered.
2. Have insurance agent speak on uses of insurance.
3. Have financial officer, bank executive or land bank officer speak on developing credit and borrowing.
4. Have local town planner or recreation director speak to class on recreational areas and activities as well as general land use planning.

NATURAL RESOURCES CURRICULUM

UNIT: Timber Management Practices

LENGTH: 6 Weeks

WHEN TAUGHT: Grade 11 or 12, Fall, Winter, or Spring

OBJECTIVES: The student will be able to:

1. prescribe for a specific forest product on a given plantation of any age the timing, method and intensity of the next weeding, thinning or pruning.
2. when given a forest area and timber stand improvement practices to be implemented, complete the prescribed practices with competence required to obtain the desired results.
3. identify and implement the different types of harvest cuttings that are used in even-aged and uneven-aged forests in this area with complete accuracy.
4. identify the different government and professional management organizations and explain the services they provide forest landowners.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Forestry Technician	484 (3, 5)
Forestry Aide	540 (1)
Wood Producer	550-555
Christmas Tree Grower	578-580 (1i, 2, 8)

CONTENT:

I. Selecting timber stand improvement practices
    A. analyzing the forest
        1. determining forest condition
        2. determining forest composition
        3. determining forest age and growth
    B. identifying management goals

II. Implementing timber stand improvement practices

- A. weeding a forest plantation
  - 1. using mechanical methods
    - a. operating the equipment
    - b. maintaining the equipment
  - 2. using chemical methods
    - a. selecting chemicals
    - b. operating the equipment
    - c. maintaining the equipment
- B. thinning a forest plantation
  - 1. determining the method of thinning
    - a. using the selection system
    - b. using row thinning
  - 2. operating and maintaining the equipment
- C. making pre-commercial and subsequent thinnings
  - 1. making release (liberation) cuttings
  - 2. making improvement cuttings
  - 3. selecting and applying chemicals
  - 4. operating and maintaining the equipment
- D. pruning the forest plantation
  - 1. determining the best season for pruning
  - 2. determining age of the stand and amount of pruning required
  - 3. operating and maintaining the equipment

III. Identifying types of harvest cuttings

- A. identifying types of cuttings used in even-aged forests
  - 1. clear cutting
  - 2. seed-tree cutting
  - 3. shelterwood cutting
  - 4. other

B. identifying types of cuttings used in uneven-aged forests

1. selective cutting
2. diameter limit cutting
3. other

IV. Identifying advantages and disadvantages of each type of harvest cutting

A. ease of logging operation
B. income produced
C. effect on soil, water and wildlife
D. effect on forest regeneration

V. Identifying forest management services

A. determining federal, state and county government agencies and services
B. determining professional and private conservation organizations and services
C. identifying forest research organizations and services

TEACHER ACTIVITIES:

1. Arrange field trips to forested areas that have been recently harvested.

2. Demonstrate safe equipment handling by students.

3. Use increment borer to demonstrate age and growth of trees.

4. Invite representatives of different forest organizations to discuss programs and services.

5. Arrange a field trip to forest experiment station or research laboratory.

6. Contact the Harvard Museum in Peterboro, Massachusetts, to arrange a field trip.

STUDENT ACTIVITIES:

1. Interpret inventory information.

2. Recommend timber stand improvement practices on a given stand of timber and be able to defend their recommendations.

3. Demonstrate safe equipment operation while implementing appropriate timber stand improvement practices on the school forest or on a cooperator's woodlot.

4. Use an increment borer to show the effects of timber stand improvement practices on the growth rate of trees.

5. Visit forest areas that have been harvested to observe the type of harvest cutting used and its effects on the soil, water, wildlife and remaining forest.

EVALUATION:

1. Have each student determine the timber stand improvement practices needed on a given woodlot or plantation. Have a service forester or forest industry employee assist in the evaluation of the student's recommendations and indicate his observations concerning needed timber stand improvements.

2. Have each student demonstrate his ability to operate and maintain tools and equipment used in timber stand improvement. The evaluation should include correctness of equipment operation and maintenance as well as observance of safety precautions.

3. Have each student define each harvest cutting method and list their advantages and disadvantages.

4. Have each student list six forest management organizations and describe the services they provide.

RESOURCES:

1. Hard hats, eye protection, ear protection, chaps, etc.

2. Chain saws.

3. Tree increment borer.

4. Pruning equipment.

5. Paint (marking) guns.

6. Tree injectors.

7. Chemical sprayers.

BIBLIOGRAPHY:

1. Management of Forest Resources for Multiple Use, Dept. of Agricultural Education, The Pennsylvania State University, University Park, PA, 1970.
2. Managing the Family Forest, Bulletin No. F 2187, Dept. of Agriculture, U.S. Government Printing Office, Washington, D.C., 1962.
3. Products From Our Forests - Their Manufacture and Use, Dept. of Agricultural Education, The Pennsylvania State University, University Park, PA, 1970.
4. Forestry, Merit Badge Series, Boy Scouts of America, North Brunswick, New Jersey, 1976.
5. Leak, W.B., Solomon, D.S., Filip, S.M., A Silvicultural Guide for Northern Hardwoods in the Northeast, U.S.D.A. Forest Service Research Paper, N.E. - 143, 1969.
6. Roach, B.A., Gingrick, S.F., Even-Aged Silviculture for Upland Central Hardwoods, Agriculture Handbook #55, U.S.D.A. Forest Service, 1968.
7. Forbes, R.D., Woodlands for Profit and Pleasure, The American Forestry Assoc., 1319-18th Street N.W., Washington, D.C., 20036.
8. Managing the Small Forest, Bulletin No. 1989, U.S.D.A., 1957.
9. Forest Improvement Cutting, Cooperative Extension Service, The University of Connecticut, Storrs, Connecticut.
10. Why TSI?, U.S.D.A. Forest Service Pamphlet #PA-901.
11. Forest Tree Pruning Guide, Publication #361, Cooperative Extension Service, University of Massachusetts, Amherst.
12. Weeding Forest Stands, Publication #372, Cooperative Extension Service, University of Massachusetts, Amherst.
13. Thinning Forest Stands, Publication #376, Cooperative Extension Service, University of Massachusetts, Amherst.
14. Forestry Incentives Program, U.S.D.A. Agricultural Stabilization and Conservation Service.

15. Improve Your Woodlot by Cutting Firewood, U.S.D.A. Forest Service Northeastern Area, State & Private Forestry, Upper Darby, PA, 19082.

16. Field Reference Handbook for Service Forests, U.S.D.A. Forest Service Northeastern Area.

17. Log Rule and Lumber Scale, U.S.D.A. Forest Service Northeastern Area.

18. Major Specifications for Forest Service Hardwood Sawlog Grades, U.S.D.A. Forest Service Northeastern Area.

19. The International Log Rule/Volume Table/International Rule Tree Scale, U.S.D.A. Forest Service Northeastern Area.

20. Logging Farm Wood Crops, Bulletin #2090, U.S.D.A.

NATURAL RESOURCES CURRICULUM

UNIT: Tree Identification

LENGTH: 3 Weeks

WHEN TAUGHT: Grade 11 or 12, early Fall or late Spring

OBJECTIVES: The student will be able to:

1. identify by scientific and/or common name the economically important trees found in Connecticut.
2. identify trees by mature bark or twig samples
3. develop and/or use a key for use in identifying trees

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Forest Insect Ranger	570 (2)
Christmas Tree Farmer	578 (1a, f, k)

CONTENT:

I. Identifying trees
    A. using leaf characteristics
        1. determining type of leaf arrangement
        2. identifying type of margin
        3. considering size and shape
        4. considering texture and color
    B. observing flowers
    C. observing type of fruit present
        1. identifying nuts
        2. identifying berries
        3. identifying cones
        4. identifying winged fruit pods
    D. using twig characteristics
        1. identifying characteristics of buds and leaf scars
        2. considering pith characteristics
        3. considering color

E. using the bark

    1. determining roughness
    2. determining color

F. using taste and smell

G. observing tree growth characteristics

    1. considering shape of crown
    2. considering persistence of dead branches
    3. buttressing or swelling of lower trunk

H. observing the site conditions

    1. considering topographic features
    2. considering soil type, condition and drainage
    3. considering surrounding vegetation

I. identifying the range or distribution of tree species

    1. considering the soils present
    2. considering the climate

J. identifying hybrid species

TEACHER ACTIVITIES:

1. Have an employee in the forest industry stress importance of correct tree identification.

2. Take classes to forests to identify trees growing on different sites.

3. Provide and demonstrate the use of a dichotomous key.

4. Make up cards containing the identifying characteristics of the trees to identify.

5. Set up a tree identification trail on the school land laboratory.

STUDENT ACTIVITIES:

1. Use tree identification references and tree keys for the state or region to identify various trees on the school land laboratory by their common and/or scientific names.
2. Develop with tree identification keys, diagrams and leaf, bud and twig specimens of the economically important trees found in the area.

EVALUATION:

1. Set up several tree identification trails as a practical exam, students must get at least eighty percent of the trees correct or be retested.
2. On the same tree identification trail, during the winter if possible, have class identify the same trees with twig and bark samples, with at least fifty percent accuracy.

RESOURCES:

1. Woodlot containing as many of the economically important native species as possible.
2. Leaves, bark, twigs, fruits for tree identification. Pictures, slides, filmstrips and other similar aids can be also used.
3. Plant keys for common trees.

BIBLIOGRAPHY:

1. Collinwood and Brush, Knowing Your Trees, American Forestry Association.
2. Fenska, Richard R., The Complete Modern Tree Experts Manual, Dodd, Mead & Co., New York, 1959.
3. Gray, Asa, Manual of the Botany of the Northern United States, Ivison and Phinney, 1958.
4. Grimm, William Carey, How to Recognize Trees, Castle Books, New York, 1962.
5. Important Trees of Eastern Forests, U.S. Dept. of Agriculture, Forest Service, 1968.
6. Peattie, Donald, A Natural History of Trees, Bonanza Books, 1976.

NATURAL RESOURCES CURRICULUM

UNIT: Water Supply and Quality Determination

LENGTH: 3 Weeks

WHEN TAUGHT: Grade 11 or 12, Spring

OBJECTIVES: The student will be able to:

1. write a description the hydrologic cycle processes which should include precipitation, evaporation, transpiration and condensation.

3. when given a specified land area, identify the available surface water and ground water supplies which should include waterways, water impoundments and aquifers.

3. when given a specified community size and location, estimate the annual, monthly and daily demand for water to the satisfaction of the instructor.

4. using water test kits, determine the quality of a given sample of water within the limits of the testing equipment.

5. when given a specified watershed, identify the present and potential sources and types of water pollution and their effects on the natural resources of the area.

6. when given a watershed with identified water pollution sources, determine the alternative methods which could be used to correct the problem to meet local and/or state pollution regulations.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Fish Conservation Officer	476 (8, 9)
Fish Research Technician	480-481 (1, 4b, d, 5, 6, 7)
Soil Conservation Technician	517-518 (2f, 3h, 4)
Water Treatment Plant Operator	520-521 (1, 2, 5)
Waste Water Technician	522 (2)
Conservation Aide	526 (2)

CONTENT:

I. Identifying the hydrolic cycle processes

- A. precipitation
- B. evaporation
- C. transpiration
- D. condensation
- E. runoff
- F. infiltration
- G. percolation

II. Determining available surface water and ground water supplies

- A. measuring precipitation
- B. determining flowing water supplies
- C. determining water impoundment supplies
- D. identifying ground water supplies
    1. aquifers and groundwater movement
    2. springs
    3. artesian wells
    4. drilled wells

III. Estimating community demands for water

- A. determining demand factors
    1. community size
    2. living standards
    3. climate
    4. water quality
- B. identifying major water users
    1. domestic usage
    2. industrial usage
    3. agricultural demands
    4. commercials

IV. Evaluating water quality

- A. determining water quality
    1. microorganism/coliform
    2. taste
    3. odor

B. determining physical quality

   1. hardness
   2. corrosiveness
   3. color/turbidity

C. determining chemical quality

   1. pH
   2. oxygen
   3. carbon dioxide
   4. nitrate
   5. phosphate
   6. salinity
   7. acidity
   8. alkalinity
   9. hardness

D. identifying natural and man-made pollutants

   1. oxygen-demanding wastes
   2. disease-causing agents
   3. plant nutrients
   4. synthetic organic chemicals
   5. inorganic chemical and mineral substances
   6. sediment
   7. radioactive substances
   8. heat

V. Identifying present and potential water pollution sources

A. domestic pollution
B. agricultural pollution
C. industrial pollution
D. identifying effects of pollution

   1. fish
   2. wildlife
   3. vegetation
   4. recreational water usage
   5. water potability

E. identifying methods of water treatment

   1. aeration
   2. flocculation
   3. filtration
   4. chlorination

VI. Identifying methods of water pollution control

- A. watershed management and protection
- B. disposal of pollutants without treatment
  1. dilution
  2. irrigation
  3. lagoons
- C. treatment methods
  1. primary, secondary, tertiary, and advanced methods
  2. disinfection and deodorization
  3. private disposal systems

TEACHER ACTIVITIES:

1. Have a Soil Conservation Service representative discuss sources and amounts of water in the area.

2. Arrange a field trip to a watershed.

3. Arrange field trips to local water purification and waste water treatment plants.

4. Prepare water samples for students to test.

STUDENT ACTIVITIES:

1. Make a terrarium so that they can observe many of the processes which occur during the hydrolic cycle.

2. In sunlight, set up a demonstration using sweet potatoes in containers of water to show water loss through transpiration.

3. Determine the average inches of rainfall in an acre area and convert it into gallons.

4. Read the home water meter at the same time daily for 30 days and determine the average daily water consumption for each family.

5. Locate the three largest users of water in the community and determine their daily water requirements.

6. Bring in a sample of water from a waterway, water impoundment or home water supply and test it to determine its quality.

7. Take a field trip to a watershed and locate possible pollution sources. Collect samples from these sources and analyze them.

8. Identify the methods being used in the community control water pollution including wastewater treatment installations, wastewater lagoons, and private disposal systems. Analyze each for their effectiveness.

EVALUATION:

1. Have each student diagram the hydrolic cycle and define all terms that should be included.

2. Assign the students a land area for which they are to calculate the volume of water flowing in the waterways and amount of water in the water impoundments.

3. Have the students calculate the monthly demand for water in a specified community when given the number of homes and their average daily consumption, the number and size farms, and any industrial usage.

4. For a given water sample previously tested by the instructor, have each student determine the water quality and presence of any pollutants. The students should be evaluated for correctness of technique and test results for which some error should be expected.

5. Develop a matching test in which the students are to match different pollutants commonly found in watersheds with their most probable sources.

6. Give the students hypothetical situations in which water pollutants and their sources have been defined. Have each student indicate the method which could be used to solve the problems.

RESOURCES:

1. Water test kits - water control and water pollution.

2. Rain gauge.

BIBLIOGRAPHY:

1. A Connecticut Water Primer, Connecticut Cooperative Extension Service, Storrs, CT.
2. Planning for an Individual Water System, Athens, Georgia: Engineering Center, American Association for Vocational Instructional Materials, 1973.
3. A Primer on Ground Water, U.S. Department of the Interior, U.S. Government Printing Office, Washington, D.C., 1970.
4. A Primer on Water, U.S. Department of the Interior, U.S. Government Printing Office, Washington, D.C., 1960.
5. A Primer on Water Quality, U.S. Department of the Interior, U.S. Government Printing Office, Washington, D.C., 1965.
6. A Primer on Waste Water Treatment, U.S. Department of the Interior, U.S. Government Printing Office, Washington, D.C., 1971.
7. Renn, Dr. Charles E., Investigating Water Problems, LaMotte Chemical Products Company, Chestertown, MD, 1978.
8. Renn, Dr. Charles E., A Study of Water Quality, LaMotte Chemical Products Company, Chestertown, MD, 1968.
9. Renn, Dr. Charles E., Our Environment Battles Water Pollution, LaMotte Chemical Products Company, Chestertown, MD, 1969.
10. Testing and Improving the Home Water Supply, Connecticut Cooperative Extension Service, Storrs, CT.
11. Water Quality Standards, Department of Environmental Protection, State Office Building, Hartford, CT.

NATURAL RESOURCES CURRICULUM

UNIT:	Wildlife Management
LENGTH:	6 Weeks
WHEN TAUGHT:	Grade 11 or 12, October-November

OBJECTIVES: The student will be able to:

1. explain the historical development of the "conservation ethic" in the United States.
2. discuss the positive and negative aspects of wild animal populations.
3. define the terms: wildlife, game and game management.
4. apply scientific technique to solve problems.
5. identify life zones of the world and representative flora and fauna.
6. explain the process known as "ecological succession".
7. define the terms: "range" and "carrying capacity".
8. identify the factors that influence wildlife populations.
9. utilize basic censusing techniques.
10. know basic breeding patterns and requirements of wildlife as well as factors that might lower productivity.
11. know basic aging and sexing techniques to be used on wildlife.
12. define the term "predator" and be able to list examples.
13. know the pros and cons of predator control.
14. identify different types of predator controls.
15. be familiar with the laws concerning wildlife in Connecticut.
16. identify the benefits and shortcomings of stocking programs.
17. identify the benefits and limitations of refuges.
18. understand the term "habitat improvement".
19. understand how such practices as controlled burning, mowing, seeding, planting, and water level control can improve habitat.

20. explain the general precautions and safety rules for firearms safety at home and in the field.

21. identify ignition system action types, gun parts and ammunition components.

22. discuss the primary rules for safe gun handling.

23. handle firearms safely at home, when transporting and in the field.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Fish Conservation Officer	475 (3, 4, 6, 7, 8)
Fish Hatchery Worker	477-479
Fish Research Technician	481-482 (3, 4, 9, 10)
Forestry Technician	486 (12)
Commercial Fisherman	497 (7)
Hunting and Fishing Guide	511 (2, 3, 5)
Conservation Aide	526 (4, 10, 11)
Conservation Officer	529 (3, 4, 6, 7, 11, 12)
Game Farmer	531-534 (1, 14, 22)
Wildlife Technician	535-537 (1a, 2, 3, 5, 6, 10, 11, 14)

CONTENT:

I. History and evolution of game management

  A. historical development of "conservation ethic"
  B. values and negative aspects of wildlife
  C. definitions of wildlife, game, and game management
  D. scientific techniques

II. Wildlife range

  A. life zones
  B. succession
  C. requirements of range

    1. food and water
    2. cover
    3. carrying capacity

III. Wildlife populations

  A. growth patterns
  B. welfare factors and decimators
  C. cycling
  D. censusing and sampling techniques

IV. Productivity

- A. breeding patterns
- B. factors lowering productivity
- C. measurements of area productivity
- D. measurements of biotic productivity
- E. aging and sexing techniques

V. Predator control

- A. determination of diet
- B. types of predation
- C. pros and cons of control
- D. methods of control

VI. Hunting and regulations

- A. role of hunting in management
- B. Connecticut regulations
- C. sportsmanship/hunter ethics
- D. firearms
  - 1. action types
  - 2. ammunition
  - 3. safe handling
  - 4. loading
  - 5. carrying
- E. check stations

VII. Stocking

- A. benefits
- B. limitations
- C. considerations before stocking

VIII. Refuges

- A. purpose and value
- B. limitations
- C. types of refuges

IX. Habitat improvement

- A. food
- B. cover

C. improvement techniques

   1. fire
   2. cutting
   3. mowing
   4. planting
   5. water control
   6. lime and fertilizer

TEACHER ACTIVITIES:

1. Lead class discussions.

2. Contact local conservation officer to help arrange field trips and to speak to class.

3. Contact local gun club to arrange for practical experiences in firing and handling guns.

STUDENT ACTIVITIES:

1. Participate in class discussions led by the instructor.

2. Orally present two magazine article reviews on approved wildlife management topics.

3. View slide presentations of the world's life zones and representative flora and fauna.

4. View films on plant succession, the Whitetail deer in New York State, and the role of hunting in management.

5. Perform basic math computations to solve problems concerning animal populations.

6. Cast plaster animal tracks.

7. Prepare a study skin.

8. Study dental patterns of wild animals.

9. Visit a fish hatchery and a pheasant farm.

10. Participate in pheasant stocking.

11. Visit a deer check station.

12. Implement an individual habitat improvement project.

13. Train and try out for the Natural Resources Contest.

14. Explain safety precautions for firearms handling.

15. Practice carrying and passing firearms.

16. Practice firing gun properly at local gun club under supervision of instructor with help of club members.

EVALUATION:

1. Evaluate participation in class discussions.

2. Written quizzes and exams.

3. Grade oral magazine article reviews.

4. Student's plaster cast and study skin will be graded.

5. Grade student's personal habitat improvement project.

6. Rate identification of firearm action types and parts.

7. Rate demonstration of safe gun handling.

RESOURCES:

1. State Conservation or Environmental Protection Agency periodicals.

2. Local pheasant farm.

3. D.E.P. deer check station and staff.

4. D.E.P. fish hatchery

5. Project Learn films.

6. Local fish and game club lands.

7. NRA Hunter Safety and Conservation Program, Student's Manual.

8. State of Connecticut Hunting, Trapping and Fishing Abstracts.

BIBLIOGRAPHY:

1. Dasmann, Wildlife Biology, (text).
2. Leopold, Game Management, (text).
3. NRA Hunter Safety and Conservation Program, Instructors' Manual and Supplements.
4. Trippensee, Wildlife Management, (text).
5. The Wildlife Society, Wildlife Management Techniques, (text).

MEDIA:

1. The Care of the Big Horn Sheep. Two part filmstrips discussing the problem of the diminishing Bighorn populations. Filmstrips display the scientific method, available from Prentice-Hall Media, New York.
2. A Question of Hunting. Available through the Department of Environmental Protection, Information and Education, State Office Building, Hartford, Connecticut.
3. Shoot, Don't Shoot. Available through Connecticut State Department of Environmental Protection.

AQUACULTURE UNIT OVERVIEW

Culture: Cranberry Culture
Fresh and Tidal Water Surveys
Shellfish
Fish Culture

Gear: Rope Splicing and Knots
Fishing Gear

Management: Aquaculture Business Management
Independent Aquaculture Project

Marine Life: Components
Flounder, Bluefish, Mackerel
Saltwater Fishing
Lobstering

Taxonomy: Career Awareness
FFA
Occupational Experience Program
Pipe and Pipe Fitting
Metals and Welding

Major Texts:

1. Allen, Richard: Atlantic Fisherman's Handbook, Fisheries Communication, Inc., Box 37, Stonington, Maine 04681; 1982.
2. Bower, Carl E.: The Sea is the Easiest Place on Earth to Live, Children's Museum of Hartford, West Hartford, CT 06119; 1975.
3. Department of Environmental Protection: Marine Resources Management Plan for the State of Connecticut, Marine Fisheries Program, Hartford, CT; July 1984.
4. Department of Environmental Protection: Study of Marine Recreational Fisheries in Connecticut, Marine Fisheries Program, Hartford, CT; March 1, 1981-February 28, 1984.
5. Weiss, Howard M. & Dorsey, Michael W.: Investigating the Marine Environment: A Sourcebook, Vol 1, 2, & 3, Project Oceanology, Avery Point, Groton, CT 06340; 1979.

Major Equipment:

1. Buy, rent, or lease vehicle for transporting students to field trip areas.
2. Lease tidal land for fish and shellfish culturing.
3. School culture mediums for shellfish experiments.
4. Lease inland cranberry bog based on determined profitability.
5. Fishing gear in sufficient quantities for class sizes.
6. Buy, rent, or lease equipped fishing boat for "Marine Life" units.
7. Equipment for "Taxonomy" and "Management" units currently available at regional Vo-Ag Centers.
8. Future purchase of transportation vehicle for fish marketing.

BOAT UNIT OVERVIEW

Allied:	Boating Accidents First Aid Weather Trailering
Engine:	Boat Handling Small Gas Engines Outboard Engines and Boats Hydraulics
Navigation:	Charts and Compass Tides and Currents Electronics Piloting
Wood:	Wood and Tools Paint and Fiberglass Boat Repair and Maintenance Boat Building

Major Texts:

1. Allen, Richard: *Atlantic Fisherman's Handbook*, Fisheries Communications, Inc., Box 37, Stonington, Maine 04681; 1982.

2. Chapman, C.F.: *Piloting, Seamanship and Small Boat Handling*, The Hearst Corporation, New York, NY; 1974.

3. Editors of One-Design and Offshore Yachtsman: *Encyclopedia of Sailing*, Harper and Row Publishers, Inc., New York, NY; 1971.

4. Phipps, Lloyd J., et al: *Farm Mechanics Text and Handbook*, The Interstate Printers and Publishers, Inc., Danville, Illinois; 1959.

5. Reed: *Nautical Almanac & Coast Pilot*, Thomas Reed pub. Co., London, England; 1983. Available through the Better Boating Association, Box 407, Needham, Mass., 02192.

Major Equipment:

1. One or more outboard boat(s) with suitable engine and equipment.
2. Buy, rent, or lease 40' boat fully equipped with all electronic gear mentioned in units.
3. New or repairable trailer equipped to carry outboard.
4. Rent or lease tow vehicle.
5. Repairable outboard engines for use or resale.
6. Repairable wood hulls for use or resale.
7. Equipment for "Engine" and "Wood" units currently available at regional Vo-Ag Centers.
8. Special outboard engine tools.

SUGGESTED DIVISION AND TEACHING SEQUENCE OF UNITS

(in alphabetical order)

Freshmen:	Boat Handling Boating Accidents *Career Awareness Charts and Compass First Aid *FFA Marine Life Components *Occupational Experience Program Pipe and Pipe Fitting Rope Splicing and Knots Wood and Tools
Sophomores:	Cranberry Culture Fishing Gear Flounder, Bluefish, Mackerel Fresh and Tidal Water Surveys Metals and Welding Paint and Fiberglass Small Gas Engines Tides and Currents
Juniors:	Aquaculture Business Management Boat Repair and Maintenance Electronics Outboard Engines and Boats Shellfish Culture Saltwater Fishing Weather
Seniors:	Boat Building Hydraulics Independent Aquaculture Project Lobstering Piloting Fish Culture Trailering

*Units are found in the Connecticut Vocational Agriculture Curriculum.

AQUACULTURE CURRICULUM

UNIT: Boat Handling

LENGTH: 4 weeks

WHEN TAUGHT: Grade 9

CONCEPT: Basic knowledge is essential for safety.

OBJECTIVES: The student will be able to:

1. develop a list of nautical terms and understand their meaning.
2. know the rules of the "road", including right of way.
3. know the boating laws and regulations.
4. recognize and identify warning signals and navigational lights.
5. identify the various types of lifesaving and required equipment.
6. properly determine correct anchorage.
7. land at dock, anchor in various winds and currents.
8. handle a boat in tight quarters and underway.
9. handle a vessel in adverse conditions.
10. determine course of action in emergencies.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Fish Conservation Officer	476 (10b)
Commercial Fisherman	496-497 (3, 5d, 6)
Fisheries Technician - Marine	500 (9)
Hunting and Fishing Guide	512 (4)

CONTENT:

1. Nautical Terms
    a. general--fore, aft, amidship, windward, leeward, etc.
    b. types of vessels
    c. directions aboard a boat--port, starboard, etc.
    d. directions from the boat--abaft, abeam, astern, underway, etc.
    e. powerboat construction terms

2. Rules of the "Road": Passing Signals
   a. meeting situations
   b. crossing situations
   c. overtaking situations
   d. meeting in restricted waters
   e. rounding bands in channels
   f. leaving a berth
   g. sailing vessels versus power vessels
   h. fishing vessels

3. Laws and Regulations
   a. registration and numbering
   b. federal and state jurisdiction
   c. Federal Boat Safety Act
   d. required equipment
   e. accident reporting
   f. licenses of operators
   g. navigational lights

4. Anchoring
   a. types
   b. anchor scope and size
   c. stowage, care, and inspection
   d. how to anchor--sandy, rocky bottom
   e. getting underway
   f. moorings
   g. docking; rafting; tying up; undocking

5. Boat Handling
   a. duties and responsibilities of the skipper
   b. rudder and propeller actions
   c. forward, reverse, and steering
   d. turning in close quarters
   e. turning while underway
   f. landing at dock, mooring, rafting
   g. landing in windward or leeward
   h. landing in currents

TEACHER ACTIVITIES:

1. Assemble equipment, handouts, and audio-visual aids to assist in compiling and explaining the various nautical terms.

2. Assemble safety equipment and gear.

3. Allow time for students to practice additional competencies with them.
4. Arrange field trips.
5. Demonstrate and discuss boat handling skills.
6. Supervise student boat handling.
7. Allow time for student review of man overboard drills.
8. Arrange for guest speaker from the U.S. Coast Guard and Power Squadron.

STUDENT ACTIVITIES:

1. Maintain notebook of terms and completed handouts.
2. Enhance competencies with safety equipment and man overboard drills.
3. Record and explain all rules and regulations.
4. Determine lights needed on board.
5. Demonstrate correct way to handle and use an anchor.
6. Demonstrate competency to dock, anchor, and skipper a boat.
7. Write appreciation letters to guest speakers.

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AQUACULTURE CURRICULUM

UNIT: Boating Accidents

LENGTH: 4 weeks

WHEN TAUGHT: Grade 9

CONCEPT: Knowledge as to how the most common accidents occur may reduce the number in the future.

OBJECTIVES: The student will be able to:

1. discuss the causes of boating accidents.
2. establish procedures to minimize the chance of an accident.
3. use properly liferafts and life jackets.
4. describe initial action to be taken on discovering a fire and to use properly the fire extinguisher.
5. describe initial actions for man overboard and demonstrate ability to throw ring or heave line.
6. explain ways to guard against hypothermia.
7. use distress signals to gain assistance.
8. recognize and know the meaning of the various channel buoys.
9. enter and exit a harbor correctly.
10. accurately report the accident to the proper authority.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Fish Conservation Officer	476 (10)
Commercial Fisherman	497 (6)
Fisheries Technician - Marine	500 (9)
Hunting and Fishing Guide	512 (4)
Fire Ranger	565-566 (11, 15, 16)
Forest Fire Fighter	568 (1, 5)

CONTENT:

1. Causes of Accidents

    a. engine too powerful or too heavy for the boat
    b. high speed turns
    c. overloading
    d. sitting on gunwales or deck
    e. damage from wakes
    f. damage from floating or submerged objects
    g. lack of personal floating devices
    h. explosion and fire
    i. foul weather--fog and thunderstorms
    j. sailing without lights
    k. venturing into conditions beyond boat's ability to safely operate
    l. inexperienced operators
    m. operating while under the influence
    n. venturing into waters without appropriate maritime chart

2. Minimize Accidents

    a. avoid operating boat in above listed ways
    b. discuss necessity for carrying U.S. Coast Guard approved life jackets and fire extinguisher
    c. illustrate load capacity plaque on a boat
    d. proper use of ring or heave line
    e. proper use of liferaft
    f. proper use of fog horn, anchor, and paddle
    g. man overboard drills
    h. discuss hypothermia
    i. determine water depth necessary for the draft of various boats as determined by maritime charts

3. Distress Signals

    a. use of flashlight to signal SOS
    b. use of mirror to flash the sun
    c. use of the horn
    d. meaning of the color orange in relation to accidents
    e. use of the horn in relation to fog
    f. proper way to use the radio to get the most rapid assistance

4. Lights

    a. International or Inland rules
    b. length of time to be displayed
    c. bow, stern, mast, and anchor

5. Operation in Channels

    a. meaning of channel markers and their importance for safety
    b. correct way to enter and exit
    c. meaning of obstruction buoys within and outside the channel
    d. reading charts in relation to buoys

6. Role of the United States Coast Guard

    a. location of station within the student's area
    b. types of vessels they have for assistance
    c. rules and fines pertaining to necessary equipment that must be on board
    d. rules and fines for overloading
    e. rules and fines for improper handling of the boat

7. Accident reports

    a. when necessary
    b. complete a report for various accidents--hitting submerged object, fire on board, etc.

TEACHER ACTIVITIES:

1. Allow discussion periods to explain how accidents occur and prevention procedures.

2. Develop and secure resource materials, charts, audio-visual aids.

3. Assemble safety equipment and gear; demonstrate their use.

4. Prepare worksheets.

5. Arrange field trips.

6. Invite guest speakers from the U.S. Coast Guard and Power Squadrons.

7. Demonstrate use of distress signals, and display of lights.

8. Conduct man overboard drills.

9. Discuss accident reports.

STUDENT ACTIVITIES:

1. Maintain a notebook of all classroom discussions and handouts.
2. Participate in discussions and demonstrations.
3. Develop a list of "do's" and "don'ts".
4. Prepare a list of necessary safety equipment.
5. Exhibit competency to use the above list.
6. Complete worksheets.
7. Participate in man overboard drills.
8. Complete accident forms.
9. Send thank-you notes to guest speakers.

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AQUACULTURE CURRICULUM

UNIT: Navigation I - Charts & Compass

LENGTH: 4 weeks

WHEN TAUGHT: Grade 9

CONCEPT: Basic navigational aids are necessary for safety afloat.

OBJECTIVES: The student will be able to:

1. develop a list of navigational equipment necessary for inland and off-shore boating.
2. discuss need for proper navigation in fair and foul weather.
3. discuss the significance and characteristics of various navigational aids.
4. discuss the selection, installation, use and maintenance of the compass.
5. demonstrate ability to recognize common chart symbols.
6. demonstrate use of compass for plotting a fix under way or for checking position at anchor.
7. demonstrate use of compass for plotting a fix under way or for checking position at anchor.
8. plot and steer a course by compass with the aid of charts.
9. locate and describe possible hazards to navigation on that course.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Land Use Planning Aide	488 (6)
Land Use Planning Technician	491-492 (3a, b, e, j, s, 6b)
Commercial Fisherman	496 (3)
Fire Ranger	565 (5)
Forest Fire Suppression-Crewleader	576 (7)

CONTENT:

1. Navigational Aids
    a. landmarks
    b. buoys
    c. fog signals
    d. light beacons
    e. radio beams
    f. light ships
    g. electronic systems

2. Charts and Maps

    a. source
    b. coordinates
    c. direction
    d. depths
    e. topography
    f. basic symbols

3. Compass

    a. selection
    b. installation
    c. maintenance
    d. reading
    e. variation
    f. deviation
    g. error
    h. calibration
    i. true and magnetic corrections

4. Plotting Positions with Compass, Charts, Dividers, and Parallel Rules

TEACHER ACTIVITIES:

1. Secure necessary materials.

2. Use lecture periods to discuss charts, compass and other navigational aids.

3. Prepare handouts and worksheets.

4. Arrange for resource people to assist the class.

5. Assist students with the use of equipment.

6. Demonstrate triangulation.

7. Demonstrate calibration and maintenance of the compass.

8. Plan field trips.

STUDENT ACTIVITIES:

1. Maintain a notebook of all discussion periods and handouts completed.

2. Identify navigational aids and their significance.

3. Read and use charts and maps.

4. Learn all facts of the compass.

5. Plot positions using acquired skills.

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1. Chapman, C.F.: Piloting, Seamanship and Small Boat Handling, The Hearst Corporation, New York, New York; 1974.

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8. Weiss, Howard M. & Dorsey, Michael W.: Investigating the Marine Environment: A Sourcebook, Vol. 2, Project Oceanology, Avery Point, Groton, Connecticut 06340.

AQUACULTURE CURRICULUM

UNIT: First Aid

LENGTH: 4 weeks

WHEN TAUGHT: Grade 9

CONCEPT: Proper use of first aid techniques can minimize the injuries to an accident victim.

OBJECTIVES: The student will be able to:

1. discuss the importance of being able to swim in relation to personal safety and first aid procedures.
2. identify importance, scope, and limitations of first aid in treating accident victims.
3. demonstrate competencies to treat wounds, eye injuries, sprains, and fractures, shock, burn, and poisonings.
4. discuss and locate "pressure points" to control bleeding.
5. identify and treat poisons from oral substances, plants, marine life, insects, and snakes common in Connecticut.
6. discuss factors of hypothermia.
7. discuss heat exhaustion, stroke, and cramps.
8. administer artificial respiration.
9. administer Heimlich Technique.
10. discuss and demonstrate CPR for cold water drowning.
11. demonstrate proper methods for transporting injured persons.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Commercial Fisherman	497 (5a, d, e)
Fisheries Technician - Marine	500 (8a, b)
Park Maintenance Person	509 (2)
Hunting and Fishing Guide	513 (7)

CONTENT:

1. Swimming
    - a. personal safety
    - b. ring and heave line
    - c. cramps
    - d. placing others in danger
    - e. artificial respiration
2. Scope of First Aid
    - a. definition
    - b. reasons and values
    - c. limitations
    - d. agricultural resource occupations requiring first aid skills
    - e. types of skills needed in agricultural resources occupations
    - f. individual responsibility and liability
    - g. prevention of accidents
3. Wounds
    - a. definition
    - b. classification
    - c. types
    - d. common causes
    - e. open wounds
    - f. severe bleeding--pressure points
    - g. prevention of contamination and infection
    - h. bites
    - i. closed wounds
4. Eye Injuries
    - a. symptoms
    - b. precautions
    - c. removal of foreign object
    - d. eyelid
    - e. blunt injury or contusion
    - f. burns
5. Sprains and Fractures
    - a. symptoms
    - b. treatment--where they lie
    - c. first aid principles
    - d. splints
    - e. cold packs
    - f. treat for shock

6. Traumatic Shock

   a. definition
   b. causes
   c. signs and symptoms
   d. treatment objectives
   e. first aid

7. Heat Emergencies

   a. exhaustion
   b. stroke
   c. cramps

8. Burns

   a. classification
   b. do's and do NOT's for treatment
   c. chemical
   d. emergencies due to heat

9. Poisons

   a. definition
   b. causes
   c. oral
   d. plants
   e. marine life
   f. insects
   g. snakes

10. Hypothermia and Cold Water Drowning

   a. definition
   b. survival factors
   c. capsized boat
   d. first aid
   e. resuscitation
   f. avoidance

11. Manual Manipulations

   a. artificial respiration
   b. external heart massage
   c. CPR for one and two rescuers
   d. Heimlich Technique for choking

12. Transporting Injured Person
    - a. pulling
    - b. lifting
    - c. supporting
    - d. chair carry
    - e. with blankets
    - f. stretchers and litters

TEACHER ACTIVITIES

1. Provide literature, audio-visual aids, worksheets, etc.

2. Lead discussions of all content.

3. Secure video tapes from the Northeast Marine Advisory Council, 30 Coburn Hall, University of Maine, Orono, ME 04469: "Hypothermia: Think Survival, Not Rescue" and "Emergency Care."

4. Request assistance from American Red Cross personnel for demonstration of techniques.

5. Allow sufficient time for students to develop elementary competencies in treatment and techniques.

6. Provide resource materials from which students can identify and compile characteristic lists of poisonous substances, plants, marine life, insects, and snakes common to Connecticut residents.

STUDENT ACTIVITIES:

1. Compile notebook of content discussions, completed worksheets, etc.

2. Read assignments and participate in discussions.

3. Practice treatment and techniques to develop competencies.

4. Develop lists of poisonous substances, etc; include identifying characteristics, unusual characteristics, and first aid applicable.

5. Write thank you notes to guest speakers.

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2. American National Red Cross: First Aid and Personal Safety, Current Edition, Doubleday & Co., Inc., Garden City, New York.

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AQUACULTURE CURRICULUM

UNIT: Marine Life I - Components

LENGTH: 4 weeks

WHEN TAUGHT: Grade 9

CONCEPT: How fish live and breathe is basic information for the study of aquaculture.

OBJECTIVES: The student will be able to:

1. discuss the components of life.
2. explain the manner in which fish breathe.
3. determine and illustrate "Food Chain."
4. discuss and illustrate the relation between water and marine life.
5. explain the relationship between salt and buoyancy; plankton and fish.
6. relate weightlessness, pressure, and light to water and marine life.
7. explain ways to reduce beach erosion.
8. develop lists of life according to habitats.
9. illustrate habitats and marine life found in each.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Fish Research Technician	481 (6, 7, 9)
Hunting and Fishing Guide	512 (5)
Wildlife Technician	536 (2, 5, 6a, c)

CONTENT:

1. Components
    a. water
    b. air
    c. food
    d. temperature
2. Gills

3. Marine Food Chain
   a. concept
   b. diatoms
   c. photosynthesis
   d. producers, consumers, decomposers, pyramids
   e. food web

4. Water Temperature
   a. variation
   b. heaviest point
   c. ice in relation
   d. salt in relation to ice

5. Salt
   a. composition in water
   b. relation to living cells
   c. fresh vs. saltwater for fish

6. Buoyancy
   a. definition
   b. relation to gravity
   c. relation to salt

7. Plankton
   a. definition
   b. composition
   c. relation to light
   d. animal plankton
   e. animal in relation to algae
   f. "spikes and feathers", oil, and air

8. Weightlessness
   a. fish
   b. flounder and crabs

9. Pressure
   a. definition
   b. relation to air
   c. relation to animals

10. Light
    a. determinants
    b. absorb by water
    c. absorb by matter
    d. reflection

11. Shore Composition

    a. rock
    b. sandy
    c. tides
    d. erosion
    e. weathering
    f. problems

12. Habitats

    a. definition
    b. rocky coast
    c. sandy shore
    d. estuary
    e. open sea
    f. deep sea

TEACHER ACTIVITIES:

1. Gather literature and teaching aids to discuss content.

2. Provide supplies and equipment for and conduct basic experiments.

3. When applicable, request students to bring supplies from home to class.

4. Allow time for students to conduct their own experiments.

5. Provide display materials for marine life to be discussed.

6. Develop charts for food chain, water temperature, and salt.

7. Provide sands of various coarseness.

8. Provide examples of invertebrates for examination.

9. Plan field trips to Mystic Aquarium, Bluff Point State Park, and an estuary.

STUDENT ACTIVITIES:

1. Compile a notebook of class discussions, teacher aids, handouts, completed worksheets, etc.

2. Observe and demonstrate basic experiments.

3. Draw a food chain.

4. Examine carefully specimens, charts, and other visual material.

5. Draw water temperature in relation to marine life.

6. Compile a list of habitats with marine life and their characteristics to be included in notebook.
7. From that list, submit a drawing to illustrate same.
8. At Mystic Aquarium, take note of marine life discussed in class and determine additions to the habitats.
9. At Bluff Point State Park, collect samples of invertebrates, sand, and algae to be reviewed in class.
10. At the estuary, make notes and take samples of silt, plant life, and marine life to be reviewed in class.

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AQUACULTURE CURRICULUM

UNIT: Pipe and Pipe Fitting

LENGTH: 4 weeks

WHEN TAUGHT: Grade 9

CONCEPT: Students in all areas of Agriculture will use the skills of plumbing as it applies to water, air, and hydraulic applications.

OBJECTIVES: The student will be able to:

1. identify all types of pipe, fittings, fixtures, and tools.
2. select proper materials for specific uses.
3. cut, thread and fit galvanized pipe.
4. cut and sweat copper tubing and fittings.
5. develop a plumbing project, read existing plans, calculate needed materials and costs.
6. perform all the necessary skills to cut, thread, ream, and fit together galvanized, iron, copper, P.V.C., and plastic pipe.
7. develop skills necessary to complete the plumbing project.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanic	288-290 (1, 2, 3, 6, 7, 8)
Irrigation Technician	322-324 (2, 3, 7)

CONTENT:

1. Safety
    a. eye protection needed
    b. body protection, including hands and face
    c. fire extinguishers and how to use them
    d. fire blanket and use
2. Planning
    a. read and interpret plans
    b. draw acceptable plans
    c. estimate costs

3. Pipe
    a. identify
    b. characteristics of each
    c. measure, cut, thread, join together

4. Tools
    a. identify
    b. safety precautions
    c. proper selection and use
    d. care

5. Skills
    a. draw diagrams
    b. measure
    c. cut
    d. ream
    e. thread
    f. solder
    g. glue
    h. assemble
    i. test project

TEACHER ACTIVITIES:

1. Provide materials, plans or blueprints, tools, and worksheets.

2. Develop learning handouts--step by step procedures and how to use the equipment.

3. Use lecture and visual aids to explain handouts.

4. Demonstrate skills and safety procedures.

5. Secure pipe fitting film strips.

6. Supervise student activities.

7. Evaluate student projects.

STUDENT ACTIVITIES:

1. Compile a notebook of class discussions and completed handouts.

2. Draw plan and dimensions of project.

3. Select materials and equipment.

4. Practice safe procedures.

5. Perform all necessary skills.

6. Complete and test the project.

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AQUACULTURE CURRICULUM

UNIT: Rope Splicing and Knot Tying

LENGTH: 4 weeks

WHEN TAUGHT: Grade 9

CONCEPT: Knowledge of commonly used ropes, knots, and splices is essential for boat safety and gear maintenance.

OBJECTIVES: The student will be able to:

1. differentiate between rope, cordage, and cable materials; discuss their uses and care.
2. select by size and characteristics for different uses.
3. discuss the proper care and protection of rope.
4. make all knots, bends, and hitches applicable for the course of study.
5. splice fiber, synthetic, and wire rope.
6. calculate the power of tackle; select and use falls and blocks.
7. make nets for lobster pots.
8. develop a list of terms and their meanings.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Commercial Fisherman	497 (4)

CONTENT:

1. Rope
    a. materials for various uses
    b. materials and size--minimum breaking strengths
    c. rules to lengthen rope life
    d. coiling

2. Tackle and Blocks
    a. size of blocks and rope
    b. single, double, and triple purchase

3. Splicing
    a. eye
    b. short splice
    c. long splice
    d. crown
    e. to thimble

4. Knots and Hitches
    a. overhand
    b. figure eight
    c. square
    d. sheet or Becket bend
    e. bowline
    f. clove hitch
    g. half hitch
    h. half hitch to a cleat
    i. reefing line bend
    j. Fisherman's bend
    k. sheepshank
    l. cat's paw
    m. rolling hitch
    n. timber hitch
    o. blackwall hitch
    p. whipping rope end

5. Nets
    a. tie cordage to make simple fish net
    b. make netting for a small lobster pot

6. Wire Rope
    a. types, sizes, uses
    b. repair or replace
    c. swaging

TEACHER ACTIVITIES:

1. Provide study guides, charts and visual aids

2. Secure materials and equipment.

3. Demonstrate techniques required to make various knots, splices, and net making.

4. Demonstrate use of wire rope rigging.

5. Supervise student activities.

STUDENT ACTIVITIES:

1. Maintain notebook of terms, discussion, completed handouts, etc.
2. Practice knot tying, splicing, and net making.
3. Describe uses of blocks and tackle.
4. Make a net for a small lobster pot.

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AQUACULTURE CURRICULUM

UNIT: Wood I - Wood and Tools

LENGTH: 4 weeks

WHEN TAUGHT: Grade 9

CONCEPT: With "do-it-yourself" the way of the future, everyone should be familiar with and able to use basic woodworking skills.

OBJECTIVES: The student will be able to:

1. recognize, use, and properly store basic hand woodworking tools.
2. recognize the need for shop safety and correctly apply those safety procedures to classroom activities.
3. safely operate power saws.
4. read and interpret blueprint drawings.
5. make a drawing to scale.
6. determine through shop math an estimate of cost.
7. determine kinds and qualities of wood used in most building projects.
8. select the most appropriate fastener for a particular situation.
9. build a lobster pot drawn to scale.
10. discuss the concept of ghost pots in relation to 1984 regulations.

RELATED JBO TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanic	288-289 (1, 2, 3, 4)
Conservation Aide	526 (8a)
Game Farmer	534 (21)
Sawyer	556-557 (1, 2, 6)

CONTENT:

1. Use and storage of
   a. hammer
   b. screwdriver
   c. wrench
   d. pliers
   e. hand saw
   f. wood chisel
   g. hand drill

2. Shop Safety

    a. apparel
    b. behavior
    c. handling materials
    d. storing materials
    e. storing wood to prevent falls
    f. carbon monoxide and fumes (ventilation)
    g. fire fighting procedures
    h. lighting
    i. compressed air safety
    j. general first aid
    k. OSHA

3. Power Saws

    a. safety requirements for all
    b. table saw
    c. radial arm saw
    d. jigsaw

4. Basic Blueprint Drawings

    a. read and interpret
    b. select and identify drawing equipment
    c. read a scale
    d. make a drawing to scale

5. Shop Math

    a. apply dimensions to drawings
    b. compute board feet
    c. read rulers, squares, levels and gauges
    d. determine ratios (ex. concrete mixtures)
    e. determine areas, volume, capacity, and weight
    f. metric conversion

6. Common Woods Used in Construction

    a. distinction between solid and veneer
    b. distinction between solid and plywood
    c. distinction between plywood and fiberboard
    d. quality characteristics of oak, pine, white cedar, maple, etc.
    e. specialty characteristics of teak

7. Common fasteners

    a. nails
    b. screws
    c. bolts
    d. hinges
    e. glue

8. Select and Use Proper Tools to Construct a Lobster Pot: in accordance with 1984 regulations.

TEACHER ACTIVITIES

1. Demonstrate correct usage of hand tools.
2. Lead a discussion of shop safety; include storage of wood planks and sheets.
3. Conduct fire drills.
4. Discuss safe use and storage of power saws.
5. Demonstrate proper adjustment, operational features, and use.
6. Provide materials for drawings and shop math.
7. Distribute handouts and worksheets for same.
8. Collect samples of common woods used in construction.
9. Provide opportunity for inspection and discussion of same.
10. Discuss most appropriate use of fasteners.
11. Provide equipment necessary for each to construct a small lobster pot.
12. Invite personnel from DEP to discuss ghost pot regulations.

STUDENT ACTIVITIES:

1. Compile a notebook of class discussions, handouts, and completed worksheets.
2. Participate in discussions and fire drills.
3. Demonstrate correct usage and care of tools, fasteners, and other equipment.
4. Read and interpret drawings.
5. Draw and construct a lobster pot to scale in accordance to 1984 regulations.
6. Compute the cost of the pot.

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AQUACULTURE CURRICULUM

UNIT: Cranberry Culture

LENGTH: 2 weeks

WHEN TAUGHT: Grades 10-12

CONCEPT: Since cranberries once were grown in Connecticut, a review of the literature may provide a basis for interest in reviving its culture.

OBJECTIVES: The student will be able to:

1. discover the importance and economic opportunities of the industry.
2. determine the advantages and disadvantages of areas in Connecticut where cranberries could be grown.
3. examine the feasibility of local culture.
4. determine quantity and yearly temperature range of available water supply.
5. discuss the cultural needs of cranberries.
6. analyze Connecticut areas and rank in order as to projected yield.
7. based on cost reclimation of areas, determine best location for profit.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Small Fruit Farming	167-170
Production Agriculture Mechanic	296 (22)
Irrigation Technician	322-324

CONTENT:

1. Overview of the Industry
    a. scope
    b. economic importance
    c. expected yields/acre
    d. value of yields/acre
    e. costs of production/acre

2. Environment Necessary

    a. location
    b. soil type
    c. water supply
    d. drainage
    e. grading
    f. soil preparation
    g. planting
    h. varieties

3. Care of Bog

    a. frost
    b. water protection
    c. sprinklers
    d. pollination
    e. weeds and herbicides
    f. fertilizer applications
    g. insecticides
    h. disease control

4. Harvesting

    a. methods
    b. equipment
    c. bulk handling
    d. marketing

TEACHER ACTIVITIES

1. Provide necessary literature.

2. Develop worksheets.

3. Request assistance from resource persons.

4. Arrange field trips to abandoned and profitable bogs.

5. Lead discussions and assist in analysis work.

STUDENT ACTIVITIES:

1. Review the literature.

2. Maintain a notebook of discussions, field trips, and completed worksheets.

3. Research and write a report on the viability of the industry based upon analyses.

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AQUACULTURE CURRICULUM

UNIT: Fishing Gear

LENGTH: 8 weeks

WHEN TAUGHT: Grade 10

CONCEPT: The preparation, repair, and fabrication of equipment is basic in the fishing industry.

OBJECTIVES: The student will be able to:

1. attach hooks, leaders, and lures to lines by the use of various fisherman's knots.
2. repair and fabricate nets and seines.
3. acquire skills to make flies, lures, etc.
4. select and use various woods, metals, and molds to make lures, popper and jigs.
5. care for nets, lures, traps, rods and reels to extend their useful life.
6. select appropriate rod, reel, line, or poles for specific uses.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Commercial Fisherman	496-497 (2, 4)
Hunting and Fishing Guide	511 (2)

CONTENT:

1. Fisherman's Knots
    a. attaching line to leaders
    b. fly tying
    c. hitches, bends, loops
    d. dropper fly hitches and whippings
    e. line to hook, swivel and spinners
    f. wire leader and swivel attachments
2. Traps and Seines
    a. tunnel or hoop net
    b. fyke net
    c. gill net
    d. seines
    e. trap nets

3. Netmaking and Repairing
    a. shuttle and needle
    b. meshes and weaving
    c. repairing and patching
    d. increasing and decreasing mesh size
    e. making landing net

4. Care of Nets
    a. preservation
    b. treatments
    c. cleaning
    d. storage

5. Reels--Selection and Care
    a. small game, big game
    b. spinning
    c. fresh water; salt water
    d. deep water; trolling--wire line
    e. fiber and synthetic line
    f. specifications
    g. cleaning
    h. lubrication and maintenance
    i. order parts and repair

6. Poles
    a. selection
    b. types
    c. maintenance
    d. repair

7. Lures--Jigs, Poppers, etc.
    a. types, uses, selection
    b. construction

TEACHER ACTIVITIES:

1. Provide equipment, materials, plans and worksheets.

2. Secure resource persons.

3. Arrange field trips to netmakers and commercial fisheries.

4. Demonstrate the methods of tying fisherman's knots and flies.

5. Demonstrate the methods of tying, repairing, and fabrication of nets, traps, and seines.

6. Demonstrate the method to make lures (attached).

7. Introduce and discuss methods to preserve and care for nets.

8. Discuss uses and maintenance of rods, reels, lines, etc.

9. Supervise student projects.

STUDENT ACTIVITIES:

1. Complete worksheets and maintain notebooks.

2. Learn and practice making knots and bends to attach hooks, poppers, and lures to line.

3. Demonstrate skills in making flies, poppers, and lures.

4. Make flies, poppers, and lures.

5. Repair and fabricate nets.

6. As a class project, construct a fyke net, gill net, and/or tunnel net. Develop list of necessary materials and estimate costs.

7. Determine appropriate rod, reel, and line for various types of fishing.

8. Practice care and maintenance of equipment.

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AQUACULTURE CURRICULUM

UNIT: Marine Life II - Flounder, Bluefish, Mackerel

LENGTH: 4 weeks

WHEN TAUGHT: Grade 10

CONCEPT: Studies of marine life habitats are necessary to determine abundance or scarcity of particular species.

OBJECTIVES: The student will be able to:

1. describe the general characteristics of these popular fish types in Connecticut.
2. discuss probable life span.
3. explain the use, applications, and limitations of the otter trawl.
4. demonstrate reading and interpreting of salinometer information.
5. use the measuring board and calipers to determine length.
6. determine wet weight.
7. use the weight: length ratio to determine minimum size.
8. examine and determine sex, weight, length, and probable age of a mature flounder.
9. describe the food web from larva to maturity of each.
10. draw a food web for one of these.
11. as an adjunct, determine age of bi-valves.
12. discuss methods used for catching these fish.
13. develop further competency with depth finder.
14. write a report analyzing future availability of these.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Fish Conservation Officer	475-476 (1, 2, 6, 9, 10)
Fish Research Technician	480-482 (1, 3, 4, 5, 6, 7, 9)
Commercial Fisherman	496-497 (1, 2, 6, 7, 8, 10)
Fisheries Technician Marine	499-500 (1, 5, 6, 9)
Hunting and Fishing Guide	511-512 (2, 3, 4, 5)
Conservation Aide	525-526 (2, 3, 6, 10)
Conservation Officer	529-530 (3, 6)
Wildlife Technician	536-537 (2, 3, 4, 6, 10, 13, 14)

CONTENT:

1. General Characteristics: Flounder, Bluefish, Mackerel
    a. body shape and physical characteristics
    b. average length and weight when caught
    c. living conditions
    d. pollutants subjected to
    e. carnivores most eaten
    f. spawn habits
    g. herbivores consumed by larvae
    h. summer migrations
    i. living hazards

2. Otter Trawl to Sample Epifauns
    a. definitions
    b. construction and limitations
    c. boat handling while using
    d. determine conditions limiting use
    e. state laws

3. Salinometer
    a. definition
    b. how constructed
    c. affected by temperature
    d. reading
    e. interpretation of data

4. Determine Length, Weight, and Sex of Marine Animals
    a. factors that cause variations in length or weight
    b. weight:length ratio as an indicator for minimum allowable catch size
    c. construction and use of measuring board
    d. construction and use of calipers
    e. capturing for marking and tracking

5. Measuring Weight
    a. general statements
    b. wet
    c. dry
    d. ash
    e. shell vs. tissue
    f. crustaceans

6. Determine Sex
    a. ovaries vs. testes
    b. eggs vs. sperm
    c. smooth or rough

7. Counting Growth Rings (Circuli) to Determine Age of Fish and Bi-valves:
   a. factors affecting size and age
   b. summer and winter
   c. fish scales
   d. bi-valves--distinct annuli

8. Tracing Marine Food Web
   a. components
   b. pollutants and their transmission

9. Pollutants of Long Island Sound
   a. rivers
   b. streams
   c. sewage
   d. manufacturing plants
   e. nuclear power plants

10. Sportsfishing in Long Island Sound
    a. types
    b. causes for concern
    c. dangers
    d. depth finder
    e. "set and drift technique"
    f. laws

TEACHER ACTIVITIES:

1. Assemble literature, audio-visual aids, charts, nautical charts, etc.

2. Lead discussions and secure resource personnel.

3. Announce report to be written and research that should begin.

4. Describe and demonstrate use of measuring board and calipers.

5. Demonstrate weighting by wet weight.

6. Illustrate weight:length ratio.

7. Assemble bi-valve shells for age determination.

8. Allow time for developing competencies to measure, weight, and age.

9. Have flounder available for inspection and examination.

10. Allow time to gain necessary information.

11. Contact Marine Advisory Service, Sea Grant Program, University of Connecticut, Avery Point, Groton, CT 06340, to gain expertise instructor and boat for occupational experience.

STUDENT ACTIVITIES:

1. Review notebook from Marine Life I.
2. Compile notebook of class discussions, teacher aids, handouts, completed worksheets, etc.
3. Develop competencies to measure, weight, determine ratio, and examine.
4. Enhance competency with depth finder and food webs.
5. Draw a food web for one.
6. Enhance competencies in Boat Safety, Boat Handling, and Navigation II.
7. Draw a picture of the flounder examined (to scale if desired); include all pertinent facts and/or characteristics.
8. Describe kind and age of bi-valves examined.
9. Research possible pollutants of Long Island Sound from rivers, streams, sewage, manufacturing plants, nuclear power plants, etc.
10. Research production of fish in the waters over the past 25 years.
11. Write a report describing your findings in relation to fish spawning, growth patterns, food webs, migration, and future availability.
12. Write appreciation letters to all who assisted in the unit.

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AQUACULTURE CURRICULUM

UNIT: Fresh and Tidal Water Surveys

LENGTH: 8 Weeks

WHEN TAUGHT: Grade 10

CONCEPT: In order to "clean up the water," it is necessary to know its properties and the cause of its pollution.

OBJECTIVES: The student will be able to:

1. determine the correct procedure for the analysis of lakes, ponds, swamps, peat bogs, tidal marshes, and estuaries.
2. explain the correct procedures for analysis of freshwater streams.
3. use a secchi disc, forel-ule scales, hydrometer, salinometer, and Van Dorn bottle.
4. make a bucket thermometer.
5. use a bathythermograph.
6. properly record all analysis data on appropriate sheets.
7. correlate field information with management practices.
8. use a seine net.
9. identify fish species, larvae, their habitat and food cycle.
10. classify aquatic plants.
11. determine chemical and physical qualities in various bodies of water.
12. measure peat depth.
13. write a report detailing corrective action to clean up a particular body of water.
14. discuss the role of organisms in relation to fish production.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Catfish Farmer	58-60
Fish Conservation Officer	475-476 (3, 4, 8, 9)
Fish Research Technician	480-482
Forestry Technician	484 (2)
Conservation Aide	526-527 (2, 10)
Conservation Officer	529 (3, 4)
Wildlife Technician	536-537 (2, 5, 6, 10)

CONTENT:

1. Survey of Water
    - a. planning
    - b. map--base line
    - c. map--traverse line
    - d. bottom contours
    - e. map symbols
    - f. classification of bottom types
    - g. classification of aquatic plants
    - h. significance of map
    - i. water supply
    - j. water purity

2. Chemical Analysis
    - a. temperature
    - b. density
    - c. pH
    - d. salinity
    - e. chemical pollutants

3. Physical Analysis
    - a. color and turbidity
    - b. transparency
    - c. plankton
    - d. bottom
    - e. aquatic vegetation
    - f. peat depth
    - g. pollutants and contaminations
    - h. fish autopsy

4. Improvement of Lakes and Ponds
    - a. water level
    - b. water retention
    - c. sprawning
    - d. shelter
    - e. food
    - f. erosion
    - g. silt
    - h. turbidity
    - i. pollution
    - j. fertility
    - k. overpopulation
    - l. competition
    - m. diseases
    - n. parasites

5. Stream Survey

    a. main drainage
    b. name of stream
    c. tributary relationship
    d. water supply
    e. width and depth
    f. volume of flow
    g. velocity
    h. temperature
    i. dams
    j. pools and shelters
    k. color and turbidity
    l. immediate shore
    m. bottom
    n. shade
    o. fish species
    p. spawning grounds
    q. pollution
    r. chemical analysis
    s. aquatic vegetation

6. Tidal Marshes

    a. formation
    b. physical and chemical properties
    c. plants
    d. larvae
    e. predators
    f. adjacent rocky shore--marine life
    g. adjacent sandy shore--marine life
    h. pollutants
    i. endangered
    j. destruction

7. Estuary

    a. definition
    b. salinity
    c. layered
    d. physical and chemical properties
    e. marine life
    f. plant life
    g. pollution
    h. predators

8. Stream Improvement
    a. shelter
    b. food
    c. spawning facilities
    d. survival
    e. predation
    f. water supply
    g. pollutants
    h. angling pressure
    i. stocking rates

TEACHER ACTIVITIES:

1. Provide literature and other resource materials.

2. Explain maps and map reading.

3. Discuss the classification of aquatic plants.

4. Demonstrate use of new equipment; allow student time for use.

5. Provide materials and demonstrate procedure to make bucket thermometer.

6. Instruct seine preparation and use.

7. Prepare handouts, worksheets, and analysis data sheets.

8. Arrange field trips; resource personnel.

9. Lead discussions that correlate with management practices.

10. Demonstrate analysis techniques.

11. Supply research materials for fish species.

12. Contact State Agency for Federal Surplus to obtain a bathythermograph.

13. Contact the Geological Society of America, Inc., for the "GSA Rock-Color Chart."

14. Contact Project Oceanology, Avery Point, Groton, CT 06340, for its "Sediment Sizing Chart," and their assistance.

15. Acquire identification guides to rocks and minerals.

STUDENT ACTIVITIES:

1. Survey bodies of water for total analysis.
2. Develop competencies with equipment and maps.
3. Prepare map and record data.
4. Visit, consult, and work with resource persons.
5. Study the life histories of the species.
6. Investigate pollution sources and recommend solutions.
7. Determine course of action to improve the environment.
8. Write a report detailing action to clean up a particular body of water.
9. Write appreciation letters to resource personnel.

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AQUACULTURE CURRICULUM

UNIT: Metals and Welding

WHEN TAUGHT: Grade 10

OBJECTIVES: The student will be able to:

1. identify common metals.
2. identify basic metal working tools.
3. use a tap and die, drill charts.
4. sharpen a twist, drill, plane blade or wood chisel, cold chisel and screwdriver.
5. safely operate the power grinder, power hacksaw, drill press and metal working hand tools.
6. use calipers, micrometers, rulers, scribers, and screw pitch gauge.
7. select the best type of welding equipment with respect to the job to be done.
8. select the proper type of electrode or filler rod for the job to be done.
9. make correct electric arc welds in mild steel and cast iron.
10. make correct oxyacetylene welds in mild steel and cast iron.
11. determine quality and strength of weld.
12. properly and safely care for welding equipment and supplies.
13. properly braze sheet metal and cast iron.
14. cut a hole in mild steel with the arc welder and oxyacetylene cutting torch.
15. properly rehandle a tool--preferably an axe.
16. reshape and sharpen an axe or hatchet, lawn mower blades and another cutting tool using gauges and correct procedures.
17. be aware of the danger involved in using dull, mushroomed or insecurely handled tools.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanic	288-289 (1, 6, 7, 8)
Plant Maintenance Mechanic	357 (2f, 1 m, n, r, w, y)
Logging Skidder Operator	553 (5f, 1, 2)

CONTENT:

1. Safety
    a. eye protection needed
    b. protection, including hands and face
    c. fire extinguishers and how to use them
    d. fire blanket and use

2. Nut and Bolt Threading
    a. select round iron
    b. prepare round iron for using a die
    c. cut threads with a die
    d. select hand iron for a nut
    e. find center and center punch
    f. select correct drill for threaded rod
    g. select tap and die
    h. clean up when done

3. Sharpening Tools
    a. use a template
    b. check for sharpness

4. Metal Lathe
    a. select metal
    b. place in chuck
    c. adjust cutter
    d. calculate depth of cut
    e. adjust cutter
    f. place angle on lathe
    g. finish piece
    h. clean up

5. Selecting Electrodes
    a. type of welder
    b. kind of metal
    c. thickness of metal
    d. position of joint

6. Striking an Arc
    a. scratching
    b. taping

7. Running a Bead
    a. tiltelectrode in line of travel
    b. clean metal between beads
    c. cooling for strength

8. Kinds of Welds
    a. flat
    b. horizontal
    c. fillet

9. Welding with Oxyacetylene
    a. safe setup
    b. adjusting flame for welding, brazing, and cutting
    c. correct angles

10. Brazing
    a. proper metal
    b. select pressures and top
    c. use oxydizing flame
    d. use bronze rod and flux

11. Safety in Tool Sharpening and Fitting
    a. grinder use
    b. grinder care--dressing and truing wheels, adjusting tool rest
    c. tools--mushroomed heads, loose handles, dull tools, injuries
    d. guards

12. Reshaping and Sharpening an Axe or Hatchet
    a. laying out curve
    b. grinding out nicks
    c. using gauge to grind blade to proper taper
    d. using files and stones to sharpen blade

13. Sharpening Other Tools
    a. use of gauges
    b. reshaping
    c. honing
    d. testing for sharpness

14. Replacing Handles
    a. removing broken handles
    b. cleaning eye
    c. shaping handle and checking alignment
    d. resawing kerf
    e. wedging
    f. finishing and sealing

TEACHER ACTIVITIES:

1. Hand out prepared directions for each exercise.

2. Demonstrate:

    a. use of chart for tap and die
    b. use of drill, tap and die, measuring tools, and template
    c. sharpening a twist drill, cold chisel, plane blade
    d. placing stick in metal lathe
    e. adjusting metal lathe
    f. measuring stock

3. Show slides, film strips and discuss types of weld and proper operation of equipment.

4. Demonstrate:

    a. ways to strike an arc
    b. running a bead
    c. setting up oxyacetylene equipment
    d. flame adjustments
    e. cutting
    f. welding with oxyacetylene
    g. brazing with oxyacetylene

5. Secure materials to work with.

6. Preassign at least one week before section begins: each student will obtain and bring to class one tool to sharpen and one to rehandle; bring a handle.

7. Show examples of dull, mushroomed, and properly handled tools. Emphasize cost, inconvenience, and danger factors.

8. Demonstrate proper method of sharpening and refitting tools.

9. Observe and supervise student activities.

10. Evaluate students' projects.

STUDENT ACTIVITIES:

1. Complete exercises assigned.

2. Bring in tools to be sharpened.

3. Follow all safety procedures.

4. Practice:
   a. running a bead
   b. padding
   c. welding two pieces of metal together--flat weld
   d. lighting a blow pipe
   e. running a fusion weld
   f. welding two pieces of metal together with oxyacetylene and filler rod
   g. brazing two pieces of metal together
5. Obtain tools for fitting and handles before section begins.
6. Maintain a notebook of notes and handouts.
7. Fit one handle.
8. Reshape and sharpen an axe or hatchet.
9. Sharpen one other tool.
10. Sharpen lawn mower blades.
11. Make some type of simple guard for a cutting tool.
12. Make a handle holder to protect handles from vise jaws.
13. Make an axe taper gauge.

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AQUACULTURE CURRICULUM

UNIT:	Wood II - Paint and Fiberglass
WHEN TAUGHT:	Grade 10
CONCEPT:	The "finishing" of a wood project is often as important as the construction phase.
OBJECTIVES:	The student will be able to:

1. discuss safety procedures learned during Wood I.
2. improve competencies with use of power saws.
3. operate safely other power tools.
4. discuss the various grits of sandpaper; conditions which determine the grit used.
5. determine when hand sanding or which power sander should be used for a particular situation.
6. discuss and determine use of wood fillers, seam compounds, and glazing compounds.
7. prepare a surface for painting, varnishing, or fiberglassing.
8. determine the kind and amount of paint, varnish, or fiberglass and resin needed for a particular project.
9. select, mix, and apply paint.
10. mix resin and apply fiberglass.
11. replace a broken window pane correctly.
12. draw plans to scale for a student project which must include painting and fiberglassing.
13. determine cost of the project.
14. secure materials, construct, and finish the project.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanic	289 (5)
Land Use Planning Technician	491 (5)

CONTENT:

1. Safety Procedures
    a. personal habits
    b. tools--hand and power
    c. shop

2. Power Saws
    a. use
    b. care

3. Use and Care of Other Wood Power Tools
    a. router
    b. joiner
    c. planer
    d. lathe
    e. drill press
    f. sanders

4. Sandpaper
    a. grits
    b. hand sanding
    c. disc sander
    d. belt sander
    e. finish sander

5. Compounds
    a. wood fillers
    b. seam
    c. glazing

6 Fiberglassing
    a. properties--what made of an why
    b. properties of resin and its interaction with fiberglass
    c. uses of fiberglass
    d. determine amount of each needed by area to be covered
    e. temperature and humidity as factors for curing
    f. manner of application

7. Paints and Varnishes
    a. importance as a finishing product
    b. properties of each
    c. types of paint--indoor, outdoor, hull, bottom, etc.
    d. types of wood preservatives--varnish, polyurethane, cuprenol, etc.

  - e. compatibility factors of paints and varnishes.
  - f. selection of finisher most appropriate
  - g. estimating amount to be purchased
  - h. care needed before, during, and after application
  - i. use of masking tape
  - j. care, selection, and use of brushes, rollers, and sprays
  - k. temperature and humidity as factors for dying
  - l. application technique
  - m. cleaning and storage of paints and equipment

8. Glazing

   - a. importance
   - b. measuring glass
   - c. cleaning and cutting glass
   - d. prepare a sash and fit glass
   - e. brads and compound

9. Student Project which Includes Paint and/or Varnish, and Fiberglass

   - a. determine project
   - b. draw plans to scale
   - c. determine cost
   - d. obtain materials and equipment
   - e. construct
   - f. sand, fill, and sand
   - g. prime and paint
   - h. fiberglass, sand, and paint

TEACHER ACTIVITIES:

1. Conduct review discussion of safety from Wood I.

2. Allow time for use of power saws to enhance competencies.

3. Demonstrate use, care, and safety for other wood power tools.

4. Illustrate grits of sandpaper; have samples for examination and discussion of use.

5. Demonstrate use, care, and safety of power sanders.

6. Conduct discussions regarding choice of sander to use under different circumstances.

7. Discuss and illustrate applications of compounds.

8. Discuss and illustrate proper application of fiberglass and resin.

9. Conduct discussions of use, care, and purchase of paints and varnishes.

10. Illustrate proper use of brush, roller, and spray.
11. Supervise students' use of power tools, sanders, compounds, fiberglass, paint, and varnish.
12. Demonstrate correct way to remove broken glass pane and replace with a new one.
13. Supervise students' installation of new pane.
14. Accept or reject student's project drawing and specifications.
15. Supervise the selection and storage of materials.
16. Supervise the construction and finishing of the project.

STUDENT ACTIVITIES:

1. Participate in review work.
2. Develop competencies in use and maintenance of power tools.
3. Compile a notebook of all discussion work including any handouts.
4. Develop competencies for the application of compounds, sanding, paint, varnish, and fiberglassing.
5. Demonstrate ability to replace broken window pane.
6. Submit a project drawing with specifications for acceptance.
7. Construct and finish the product.

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AQUACULTURE CURRICULUM

UNIT: Small Gas Engines

LENGTH: 4 weeks

WHEN TAUGHT: Grade 10

CONCEPT: By introducing the principles of the internal combustion engine, the student will develop an understanding of design, operation, to overhaul, and trouble shoot small gasoline engines.

OBJECTIVES: The student will be able to:

1. explain the principles of operation (compression, carburetor, ignition) of two- and four-cycle engines.
2. select proper repair parts needed using service manuals, owner's manual and mircofilm.
3. practice proven methods on trouble shooting.
4. replace, clean, and regap spark plugs.
5. replace and adjust ignition points using proper tools.
6. test coil and condenser.
7. practice safety procedures.
8. identify types of carburetors.
9. adjust carburetor.
10. recognize the importance of clean fuel, oil, and lubrication.
11. prepare the engine for storage.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanic	291-292 (10, 11, 12)
Tractor Mechanics Helper	302-303 (1, 3, 4, 5, 6, 7)
Small Engine Mechanic	311 (5, 6, 7, 8, 9, 10)

CONTENT:

1. Fundamentals of Gasoline Engine
   - a. definition
   - b. fuel, oils, lubrication
   - c. cycle
   - d. parts
   - e. evaluation
2. Safety
   - a. use of solvents
   - b. handling of gasoline
   - c. disconnect spark plug
   - d. clamp engine to bench or engine stand
   - e. proper use of tools and testing equipment
3. Use of References
   - a. owner's, service, and parts' manuals
   - b. use of microfilm
   - c. cost determination
4. Carburetion
   - a. types: gravity, vacuum, fuel pump
   - b. clean carburetor
   - c. choke, adjust
   - d. air leaks
   - e. air cleaner, function and clean
   - f. linkage
5. Ignition
   - a. basic electricity--magnetic systems
   - b. clean, gap, regap, replace
   - c. breaker points--gap, regap, replace
   - d. test and replace condenser
   - e. test and replace coil
   - f. adjust air gap
   - g. disassemble, identify, evaluate, assemble
6. Compression
   - a. check compression
   - b. clean head
   - c. replace gasket
   - d. torque head bolts
   - e. inspect valves

7. Storage

    a. remove gas
    b. change oil
    c. lubricate cylinder
    d. clean air filter

TEACHER ACTIVITIES:

1. Provide manuals, handouts, textbooks, etc.

2. Lectures, readings, and demonstrations of:

    a. define operation of engines
    b. safety procedures
    c. ignition, carburetion, compression
    d. use of reference materials
    e. changing and gaping plugs
    f. inspecting wires
    g. testing coil and condenser
    h. adjusting carburetor
    i. installing points
    j. cleaning air filter

3. Supervise student safety and use of all equipment.

4. Supervise daily storage of equipment.

STUDENT ACTIVITIES:

1. Maintain notebooks of discussions, directions, visual aids and handouts.

2. Service engines.

3. Inspect, identify, assemble all systems.

4. Trouble shoot--ignition fuel problems.

5. Determine costs and order parts.

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AQUACULTURE CURRICULUM

UNIT: Navigation II - Tides and Currents

LENGTH: 8 weeks

WHEN TAUGHT: Grade 10

CONCEPT: To build on the objectives of Navigation I, additional variables must be included to allow for more sophisticated plotting of position or destination.

OBJECTIVES: The student will be able to:

1. discuss tides and their affect on navigation.
2. discuss tidal currents and their affect on navigation.
3. demonstrate the making and use of a course protractor.
4. demonstrate the making and use of a pelorus.
5. read and interpret tide charts and tidal current tables.
6. discuss and calculate boat speed in relation to "speed over the bottom: when current is in the same or opposite direction to the boat.
7. in direction of #6, calculate time it will take to propel between Point A & Point B with engines of variable speeds.
8. discuss and calculate boat speed in relation to speed over the bottom when current is at a right angle to the boat.
9. in direction of #8, calculate time it will take to propel between Point A & Point B with engines of variable speeds.
10. discuss and calculate boat speed in relation to speed over the bottom when current is at an oblique angle to the boat.
11. calculate time, in direction of #10, it will take to propel between Point A & Point B with engines of variable speeds.
12. determine depth by lead line and depth finder.
13. practice plotting with added variables.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Land Use Planning Aide	488 (6)
Land Use Planning Technician	491-492 (3a, b, e, g, j, k, 5, 6b, h, i, j)
Commercial Fisherman	496 (3a, b)
Fire Ranger	565 (5)
Forest Fire Suppression Crew Leader	576 (7)

CONTENT:

1. Tide
   a. definition
   b. types
   c. affect on navigation
2. Tidal Currents
   a. definitions
   b. types
   c. importance
   d. "speed over the bottom"
   e. current in same or opposite direction to the boat
   f. current at right angle to the boat
   g. current at oblique angle to the boat
   h. tables and interpretation
   i. affects on boat speed and direction
3. Course Protractor
   a. definition and use
   b. make and plot
4. Pelorus
   a. definition and use
   b. make and plot
5. Depth determination
   a. lead line
   b. depth finder
   c. depth notations on nautical charts

6. Plot courses using
    a. charts
    b. currents
    c. tides
    d. compass
    e. depth finder
    f. course protractor
    g. pelorus

TEACHER ACTIVITIES:

1. Review information from Navigation I as a basis for this unit.
2. Introduce information concerning tides and currents.
3. Assemble necessary books, literature, charts, and depth equipment.
4. Arrange for audio-visual aids to be used throughout the unit.
5. Acquire materials to make course protractors and peloruses.
6. Develop worksheets to be completed by students.
7. Direct class discussions of tides, tidal currents, tables, and charts.
8. Request assistance from the Power Squadron to aid students with calculation work.
9. Ask the squadron to pose hypothetical situations requiring plotting solutions.
10. Enlist assistance from the Math Department for any tutorial work.
11. Arrange trip to nearest Coast Guard Station to view actual use of navigational aids.

STUDENT ACTIVITIES:

1. Maintain notebook through discussion periods and audio-visual presentations.
2. Complete worksheets.
3. Read and discuss prescribed literature.
4. Assemble and use a course protractor.

5. Assemble and use a pelorus.
6. Read and interpret charts and tables.
7. Calculate destination times with variable engine speeds and three course directions.
8. Solve hypothetical situations through plotting.
9. Write thank you letters to Power Squadron members and the Coast Guard Station.

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AQUACULTURE CURRICULUM

UNIT: Aquaculture Business Management

LENGTH: 12 weeks

WHEN TAUGHT: Grade 11

CONCEPT: To become successful, a commercial fisherman must realize a profit.

OBJECTIVES: The student will be able to:

1. discuss the importance of business management.
2. explain the necessity to keep true and accurate records of all income and expenses incurred.
3. discuss decision-making procedures.
4. know applicable Federal and State tax laws.
5. determine whether financial assistance is needed.
6. describe marketing principles that must be considered.
7. evaluate insurance needed.
8. know which trade organization to use for assistance in various matters.
9. discuss the options in relation to fishing cooperatives.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Catfish Farmer	60 (17)
Chemical Applicator	206 (6b, c, d, e)
Agri-Chemical Occupations	216-219 (3, 7)
Manager of Grain, Fertilizer, Feed, and Seed Sales Business	234-237 (19-34)
Fish Hatchery Worker	479 (15, 16)
Commercial Fisherman	497 (11)

(1) 1. Importance

   a. profit and loss
   b. stay in business or bankruptcy
   c. commercial vs. sportsfishing problems
   d. viability of aquaculture

(2) 2. Basic Terms Used and Their Relationships

   a. income and expense
   b. receipt and disbursement
   c. simple and compound interest
   d. discount
   e. budget
   f. recordkeeping
   g. capital gain or loss
   h. assets and liabilities
   i. self-employment and income tax
   j. cost, other, and adjusted bases
   k. depreciation
   l. exemption
   m. liability and hospitalization insurance
   n. casualties
   o. profit and loss
   p. balance sheet
   q. cash flow

3. Receipts

   a. need in relation to recordkeeping and IRS
   b. types
   c. recording

4. Disbursements

   a. need in relation to recordkeeping and IRS
   b. petty cash
   c. checkbook writing--care and maintenance
   d. balancing a checkbook

5. Income

   a. sales
   b. cash
   c. checks
   d. capital gains
   e. self-employment tax
   f. recording
   g. interest from bank accounts
   h. interest from delinquent accounts
   i. income and expense sheet
   j. balance sheet

6. Expenses
    a. purchases
    b. receipts
    c. checkbook writing and balancing
    d. capital loss
    e. Social Security (FICA) and unemployment taxes
    f. recording
    g. interest payments for purchase of assets
    h. mortgage payments for purchase of assets
    i. insurance--liability, hospitalization, umbrella
    j. income and expense sheet
    k. income tax

(3) 7. Budget
    a. estimating income based on known and unknown factors
    b. estimating expenses based on known and unknown factors
    c. determining fixed expenses
    d. purchase of assets
    e. develop one

8. Business Assets
    a. purchase--cash, loan, mortgage
    b. bases--cost, other, adjusted
    c. sale--capital gain or loss
    d. depreciation

9. Records
    a. budget
    b. daily, weekly and monthly cash flow statements
    c. depreciation
    d. crew share

10. Computations
    a. simple and compound interest
    b. sales ratios in relation to discounts
    c. social security tax
    d. depreciation
    e. unemployment tax
    f. accelerated cost recovery system (ACRS)

11. Crew Share
    a. concept
    b. Federal regulations
    c. drawbacks
    d. computations

(4) 12. Connecticut Taxes for Commercial Fisherman

   a. sales tax exemptions
   b. non exemptions
   c. boat registration fee
   d. capital gains and dividend tax

13. Federal Taxes for Commercial Fisherman

   a. supplies deduction
   b. fuel deduction
   c. equipment deduction and depreciation
   d. non-allowable deductions
   e. records to be kept
   f. private use limitations
   g. crew share
   h. ACRS
   i. investment credit
   j. casualty and theft losses

14. Commercial Fisherman Tax Return

   a. Form 1040
   b. Form 4562--Depreciation and Amortization
   c. Schedule C--Profit (or Loss) from Business or Profession
   d. Form 4797--Supplemental Schedule of Gains and Losses
   e. Form 941--Employer's Quarterly Federal Tax Return
   f. Form 1099--Miscellaneous Income (Crew Share)

(5) 15. Financial Assistance

   a. sources--public, private, Federal
   b. Income and Expense sheet to determine repayment capabilities
   c. Profit and Loss Statement to determine credit rating
   d. Balance Sheet to illustrate net worth
   e. Business Assets--rent or lease as alternative to purchase
   f. down payment and interest comparisons
   g. loan application

(6) 16. Marketing Principles

   a. supply and demand components for pricing a product
   b. advertising--cost effectiveness
   c. retail, wholesale, jobber
   d. discount ratios
   e. salesmanship
   f. cooperatives
   g. computers--cost effectiveness

(7) 17. Insurance

  a. property and equipment
  b. liability
  c. FICA
  d. hospitalization
  e. umbrella
  f. workmen's compensation

(8) 18. Trade Organization Services

  a. Connecticut Extension Service
  b. Sea Grant Marine Advisory Program
  c. Farm Bureau
  d. Farm Credit Aquatic Loan
  e. National Marine Fisheries Service

(9) 19. Cooperatives

  a. concept
  b. growth
  c. cost savings
  d. those in the area

TEACHER ACTIVITIES:

1. Obtain texts, resource people, audio-visual aids, handouts, worksheets, tax returns, etc.

2. Lead discussions of importance, basics of recordkeeping, budgets, etc.

3. Provide and discuss all the implications of the checkbook.

4. Demonstrate and supervise computations, income tax return, and credit applications.

5. Invite a leader from Farm Bureau and Sea Grant Program to assist in discussions of services provided in relation to credit, assets, and tax laws.

6. Request assistance from the school's Business Education Department.

STUDENT ACTIVITIES:

1. Maintain a complete notebook of discussions, handouts, and completed worksheets and records.
2. Read assignments and participate in discussions.
3. Practice computations to develop competency.
4. Develop competency to balance a checkbook, record income and expenses, prepare profit and loss statement and balance sheet.
5. Complete credit application form and income tax returns.
6. Determine other services provided by the Trade Organizations.
7. Write appreciation letters to all resource persons.

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2. Bender, Norman: Applying for a Fishing Loan, Cooperative Extension Service Leaflet #F.S. 225, University of Maryland, College Park, Maryland 20742; 1976.
3. Bender, Norman: Retirement Plans--Preparing for the Future, Cooperative Extension Service Leaflet #F.S. 227, University of Maryland, College Park, Maryland 20742; 1977.
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AQUACULTURE CURRICULUM

UNIT: Boat Repair and Maintenance

LENGTH: 4 weeks

WHEN TAUGHT: Grade 11

CONCEPT: Develop a plan of action to perform individual projects that will enhance initiative and self-worth.

OBJECTIVES: The student will be able to:

1. understand and appreciate boat repair functions.
2. make new ribs.
3. prepare wood boat for painting.
4. repair damage and rot in a wood hull.
5. refasten and caulk wooden boat.
6. prepare fiberglass boat for painting.
7. repair fiberglass boat damage.
8. select suitable paints.
9. apply paints--spray, brush, roller.
10. work well independently and make decisions.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanic	288-289 (1, 4, 5)

CONTENT:

1. Wood Hull
    a. strip paint
    b. fabricate ribs
    c. repair damage
    d. refasten planks
    e. caulk seams
    f. sand surface

   - g. prime and sand
   - h. recaulk
   - i. reprime
   - j. paint surface

2. Fiberglass Hull

   - a. strip finish
   - b. trim damage
   - c. prepare fiberglass and resin
   - d. repair damage
   - e. gel coat
   - f. sand finish
   - g. paint surface

TEACHER ACTIVITIES:

1. Review shop procedures.

2. Provide equipment, supplies, and reference materials.

3. Review students' plans.

4. Give instruction when necessary.

5. Supervise projects.

6. Plan field trip to a marina repair shop.

7. Coordinate student projects.

STUDENT ACTIVITIES:

1. Maintain notebook of procedures used; include daily log of time and materials used.

2. Develop a plan of action that includes a budget of time.

3. Make cost estimates of repair supplies; prepare a monetary budget.

4. Order materials.

5. Store materials and record invoices.

6. Follow safety procedures.

7. Perform necessary skills to complete project.

8. Determine accuracy of monetary and time budgets based upon daily logs.

9. Submit project for evaluation.

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4. International Paint Company, Inc.: Interlux Yacht Paints, 17 Battery Place North, New York, New York 10004.
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6. Pettit Paint Company, Inc.: Bottom Paints, Rockaway, NJ 07866.
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8. Wood II: "Bibliography"
9. Woolsey Paint & Color Co., Inc.: How to Paint Your Boat, 205 East 42nd Street, New York, New York 10017.

AQUACULTURE CURRICULUM

UNIT: Navigation III - Electronics

LENGTH: 8 weeks

WHEN TAUGHT: Grade 11

CONCEPT: As navigational systems become more sophisticated, it is necessary that the student becomes familiar with the electronics involved.

OBJECTIVES: The student will be able to:

1. become familiar with electrical systems necessary to operate electronic gear.
2. discuss the necessity, and how to properly use, the radiotelephone for routine and emergency needs.
3. exhibit competencies to plot courses with the aid of depth sounders, radio direction finders, radar, and Loran.
4. discuss the possible sources of error in electronic gear.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Commercial Fisherman	496 (3)
Forest Fire Fighter	569 (12a, c)

CONTENT:

1. Systems
    - a. voltage
    - b. generator and alternator
    - c. storage battery
    - d. wiring
    - e. switches, fuses, circuit breakers
2. Radiotelephones
    - a. uses
    - b. MF, VHF, SSB
    - c. licenses
    - d. rules and regulations
    - e. station identification

3. Using a Radiotelephone
    - a. make a call
    - b. phonetic alphabet
    - c. receive a call
    - d. distress calls

4. Depth Sounders
    - a. measuring depth
    - b. using sounder
    - c. possible sources of error
    - d. application in plotting

5. Radio Direction Finder
    - a. features
    - b. bands
    - c. plotting the radio bearing
    - d. use and care of the RDF

6. Radar
    - a. principles
    - b. plotting by radar
    - c. reflectors

7. Loran
    - a. principles
    - b. receivers
    - c. plotting
    - d. possible sources of error

TEACHER ACTIVITIES:

1. Arrange field trips to rented or leased equipment.

2. Arrange for resource speakers for class discussion.

3. Assemble literature and charts.

4. Prepare handouts and worksheets.

5. Use lectures and visual aids to discuss the components, installation, maintenance, operation, etc. of electronic gear.

6. Demonstrate the use of the equipment.

7. Evaluate the data received.

8. Use the data to compute a course.

9. Discuss possible sources of error.
10. Supervise students' use of equipment to compute a complicated course.

STUDENT ACTIVITIES:

1. Maintain notebook of discussions and field trip information.
2. Complete worksheets.
3. Demonstrate competence in use of radiotelephone.
4. Determine depth by using the depth sounder; determine types of boats that could safely sail there.
5. Review all information pertaining to navigation, including the weather unit.
6. Plot courses using the equipment and its data.
7. Plot the complicated course indicated by the instructors.

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AQUACULTURE CURRICULUM

UNIT: Outboard Engines and Boats

LENGTH: 4 weeks

WHEN TAUGHT: Grade 11

CONCEPT: The efficiency, reliability, fuel economy and enjoyment of engine and boat depend on proper tuning and hull maintenance.

OBJECTIVES: The student will be able to:

1. develop competencies for proper maintenance procedures for hull and engine.
2. discuss the propeller, how it works, and how to determine the proper one for a particular boat.
3. match the engine to the boat.
4. determine proper fuel mixtures, storage tanks, and installation.
5. demonstrate proper tune-up procedures.
6. prepare for winter storage.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanic	288-291 (5, 11)
Tractor Mechanics Helper	302-303 (1, 2, 3, 4, 5, 6, 7)
Small Engine Mechanic	311 (5, 6, 7, 8, 9, 10)

CONTENT:

1. Hull Maintenance
    a. cleaning, waxing, polishing
    b. below water--service, clean, paint
    c. control corrosion
    d. drain plugs
    e. bilge pump
2. Propeller
    a. selection and care
    b. cavitation
    c. vibration
    d. rake and pitch
    e. ventilation

3. Fuel Systems

    a. tanks
    b. fuel mixtures
    c. static electricity
    d. grounding
    e. plumbing

4. Minor Tuning

    a. lubricate engine
    b. drain and replace gear oil
    c. adjust points
    d. adjust carburetor
    e. replace spark plug
    f. clean surface
    g. fine tune
    h. fuel pump check
    i. ignition system inspection
    j. battery service

5. Engine Winter Storage

    a. flush--warm to operating temperature
    b. disconnect fuel line
    c. inject rust preventative into each carburetor
    d. drain fuel tank and fuel lines
    e. clean carburetor
    f. drain and refill lower unit with gear oil
    g. lubricate throttle and shift linkage
    h. remove propeller, apply sealer and reinstall
    i. fuel filter
    j. water pump
    k. steering cable lubrication

6. Hull Winter Storage

    a. drain
    b. clean
    c. store
    d. covering
    e. shoring, cradles, poppets

TEACHER ACTIVITIES:

1. Provide equipment, textbooks, manufacturers' literature, films, etc.
2. Lead discussions and secure resource persons.
3. Demonstrate proper procedures and skills.

4. Supervise as students acquire competencies.
5. Discuss antifouling paints.
6. Direct attention to the affects of electrolysis.

STUDENT ACTIVITIES:

1. Maintain notebook of all classroom work and completed handouts.
2. Discuss hull maintenance practices.
3. Comprehend the workings of the propeller.
4. Select appropriate engine.
5. Select an appropriate propeller.
6. Determine proper fuel mixtures.
7. Properly install and maintain fuel systems.
8. Perform tune-up skills.
9. Determine how to reduce corrosion.
10. Service fuel filter and water pump.
11. Prepare boat, engine, and battery for winter storage.

BIBLIOGRAPHY:

1. Mercury Propeller Book.
2. Tune-Up and Repair Manuals from major manufacturers.

AQUACULTURE CURRICULUM

UNIT: Shellfish Culture

LENGTH: 8 weeks

WHEN TAUGHT: Grade 11

CONCEPT: Shellfishing can again become a viable profitable business if culture areas are restored to their potential condition.

OBJECTIVES: The student will be able to:

1. determine the employment, ownership and economic opportunities of shellfishing.
2. identify the various species, their life cycle, production, and growth.
3. select proper location for culture.
4. determine the requirements of closed culture systems.
5. properly manage natural growing systems.
6. select approved management procedures.
7. produce and market a quality product.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Fish Hatchery Worker	477-479
Fish Research Technician	480 (1, 3, 6, 7, 9, 10)
Fisheries Technician Marine	499-500 (1, 3, 4, 5, 6, 7)
Conservation Aide	526-527 (4, 6, 10a, b)
Conservation Officer	529-530 (3, 4, 6, 12)

CONTENT:

1. Classifications
    a. oysters
    b. hardshell clams
    c. softshell clams
    d. mussels
    e. scallops
2. Anatomy
3. Range

4. Habitat

    a. salinity
    b. temperature
    c. soil type
    d. depth
    e. pollution

5. Biology

    a. food supply
    b. digestion
    c. respiration

6. Reproduction and Growth

    a. unisexual
    b. age
    c. temperature
    d. fertilization
    e. life cycle
    f. environment and growth
    g. spawning season

7. Intensive Culture (Hatchery)

    a. closed systems
    b. food production
    c. genetic selection
    d. spawning
    e. growing systems--tanks, trays, traps, strings, nets, raft
    f. temperatures
    g. water supply and systems
    h. sanitation
    i. disease control
    j. equipment

8. Extensive Culture (Bottom)

    a. surveys--site location, leasing fees, licenses
    b. seed sources--hatchery, fishermen, self
    c. culture (grow out) procedures: relays, transplants, density management, bed rotation, soil management and cultivation, pH control, depuration (purging), disease control, harvesting seasons
    d. predator control--lime, screens, fences, cages, racks, nets
    e. transplant and harvest equipment: tongs, rakes, forks, dredges, escalator, hydraulic rake (construction and use), boat and motor, bags, crates, pails

9. Marketing
    a. consumption--direct, coop, stores, processors, legal size, grading
    b. seed--interstate commerce, permits, inspections

10. Quality Control
    a. at harvest
    b. holding
    c. transportation

11. Economic Considerations
    a. investment costs, leases, equipment
    b. expected yields/acre
    c. market value

12. Recipes

TEACHER ACTIVITIES:

1. Select necessary bibliography and assign readings.
2. Prepare handouts and arrange for resource persons.
3. Lead discussion periods.
4. Provide growing facilities.
5. Arrange field trips to Long Island Oyster Farms in New Haven and to local Shellfish Commission meetings.
6. Contact John Volk, Connecticut Department of Agriculture, for field trip to Aquaculture Division in Milford.
7. Contact Ed Rhodes, National Marine Fisheries Service, for trip to Milford.
8. Arrange trips to local seacoast shellfish farmers.

STUDENT ACTIVITIES

1. Complete assigned readings.
2. Compile notebook of discussions, handouts, field trip notes, etc.
3. Participate in school's closed system experiments.
4. Gain experience with local shell fishermen.

5. Dissect and examine parts; draw labeled diagrams.

6. Write appreciation letters to all who assisted the class.

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AQUACULTURE CURRICULUM

UNIT:	Marine Life III - Saltwater Fishing
LENGTH:	4 weeks
WHEN TAUGHT:	Grade 11
CONCEPT:	As the sea is considered to be the untapped food source of the future, knowledge of the habitats and viability of common species is essential for students of aquaculture.

OBJECTIVES: The student will be able to:

1. identify the various species and determine their seasonal migrations.
2. state where, when and with what equipment they are most abundantly caught.
3. describe preserving techniques needed for some species.
4. prepare, care for, and market the fish.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Fish Retail Cutter	379-381
Commercial Fisherman	496-498
Hunting and Fishing Guide	511-513 (1, 2, 3, 4, 5, 10)

CONTENT:

1. Species and Description
2. Biological Characteristics and Habitat
3. Migrations and Seasons
4. Feeding Habits
5. Fishing Methods--Baits and Lures
6. Preserving Methods at Catch Time
7. Cleaning, Preserving, and Preparation for Market
8. Legal Size and Economic Value
9. Marketing--Uses and Recipes

Species List:

Black Fish
Black Sea Bass
Bluefish
Bonito
Butterfish
Cod
Cunners
Fluke
Haddock
Herring
Mackerel
Menhadden
Pollock
Salmon
Scup
Shad
Shark
Smelt
Striped Bass
Sturgeon
Swordfish
Tuna
Weakfish
White Perch
Whiting
Winter Flounder
Yellowtail Flounder

TEACHER ACTIVITIES:

1. Provide literature and charts.
2. Prepare handouts and worksheets.
3. Invite guest speaker.
4. Schedule fishing trips.
5. Divide class into working groups to compile data.
6. Demonstrate rigging for live bait.
7. Demonstrate fish sealing, cleaning, filleting, etc.
8. Provide bait and fish for students' use.
9. Arrange field trips to processing plants.
10. Attempt to secure on-the-job training at the plants.
11. Lead discussions on marketing of fish.
12. Arrange a field trip to a retail fish market.
13. Distribute list of species to be researched.

STUDENT ACTIVITIES:

1. Compile a systematic notebook of species researched; include drawings, charts, etc.
2. Review material from Marine Life II.
3. Enhance competencies using the measuring board, calipers, weight:length ratio, and sex determination.
4. Complete worksheets for specie identification and information.

5. Where possible, include labeled drawing.
6. Prepare and deliver a talk on at least one species; be prepared to answer questions.
7. Participate in field trip activities.
8. Demonstrate competency to work with live bait and to clean and prepare fish.
9. Take notes at processing plants and fish market to include in the notebook.
10. Contribute to classroom discussions.
11. If desired, research a species not included on the list.
12. When possible, include research on the larvae of the species.
13. Write appreciation letters to all who assisted the class.

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AQUACULTURE CURRICULUM

UNIT: Weather and Its Affects on the Sea

LENGTH: 4 weeks

WHEN TAUGHT: Grade 11

CONCEPT: Knowledge of weather factors is essential for safety for anyone who is involved with sea activities.

OBJECTIVES: The student will be able to:

1. discuss the relationship between tides, wind and waves, and storms; their affect on boating and safety on the sea.
2. discuss the importance of weather forecasts, visual observations of sea and cloud formations, and instruments for safe boating.
3. identify cloud formations in weather forecasting.
4. discuss the dangers and determine the proper action for fog, lightning, and thunder storms.
5. determine where to find reliable weather forecasts.
6. develop a knowledge of the use of barometers and weather maps.
7. analyze weather maps, locate fronts, air masses, and estimate expected changes.
8. know why wind blows; its affect on sea weather.
9. discuss the various types of fog; how it is formed; dew points; seasonal frequency; what to do in emergencies.
10. discuss true and apparent wind, the anemometer and Beaufort scale, and its affect on the sea.
11. know the meaning of weather flags and weather lights.
12. discuss the affects of tides and currents.
13. develop a list of terms with their meanings.

CONTENT:

1. Weather Maps: National Weather Service: NOAA
    - a. symbols
    - b. lows and highs
    - c. Isobars and Fronts
    - d. estimating expected changes

2. Clouds: how formed and what they mean
    a. cirrus, cumulus, stratus, etc.
    b. stable and unstable air
    c. forecast weather

3. Barometer
    a. readings in relation to weather
    b. forecast weather

4. Wind
    a. speeds
    b. patterns
    c. fronts
    d. force
    e. shifts

5. Storm Advisories
    a. NOAA
    b. newspapers
    c. radio
    d. small-craft warnings

6. Tides and Currents
    a. tide and current charts
    b. effects of the moon

TEACHER ACTIVITIES:

1. Provide resource materials and handouts.
2. Explain significance of various cloud formations.
3. Discuss availability and sources of weather information.
4. Provide visual aids.
5. Arrange for a meteorologist to address the class.
6. Arrange a field trip to a weather station.
7. Have students monitor daily weather patterns--clouds, wind, precipitation, temperature.
8. Explain the use of the barometer, anemometer, Beaufort Scale.
9. Discuss tides and currents.

STUDENT ACTIVITIES:

1. Maintain a notebook of terms and completed worksheets.
2. Identify clouds and their prediction.
3. Demonstrate the ability to use the equipment.
4. Make a daily graph of temperature and barometric readings. Record cloud formation, tidal conditions, and type of day.
5. Participate in daily discussion of graph information and analysis.
6. Understand the affect of weather on tides and currents.
7. On the basis of cloud types, wind and direction of change and barometer, make a daily forecast for the day.

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MEDIA:

1. "Formation and Types of Clouds", British Press Educational Service, London, England.

2. "Tides of the Ocean".

AQUACULTURE CURRICULUM

UNIT: Boat Building

LENGTH: 6 weeks

WHEN TAUGHT: Grade 12

CONCEPT: Through this class project, the students learn to cooperate among themselves by building a small wood fiberglassed work boat.

OBJECTIVES: The student will be able to:

1. select a boat design to meet the class need.
2. draw and interpret design plans.
3. develop a list of needed materials and their cost.
4. create time and monetary budgets.
5. order and cut materials.
6. follow safety procedures.
7. assemble project.
8. apply fiberglass.
9. paint
10. see a group effort float in the water.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanic	288-289 (3, 4, 5)

CONTENT:

1. Planning
   a. select design
   b. draw plans
   c. create budgets for time and money
   d. order materials
   e. store materials for systematic use
   f. record invoices

2. Materials
    a. select most appropriate wood
    b. fabricate ribs, sides, bottom, supports, seats, etc.
    c. assemble parts

3. Fiberglass
    a. mix resins
    b. cut glass
    c. apply
    d. sand

4. Paint
    a. apply primer
    b. sand and recaulk
    c. reprime
    d. paint hull, bottom, and water line

5. Trailer
    a. use rollers to place boat on trailer
    b. trailer to boat launching site
    c. christen with a bottle of coke as she goes in and floats!

TEACHER ACTIVITIES:

1. Plan field trips to boat building and/or repairing marinas.
2. Coordinate and assist students' planning of project.
3. Supervise and advise during project.
4. Take care of insurance and motor vehicle regulations.

STUDENT ACTIVITIES:

1. Design a boat using group input.
2. Work as a team to construct project.
3. Improve skills of drafting, machine operation, assembly, fiberglassing, and painting.
4. Keep daily record of time spent and monies expended.
5. Compare budgeted money and times with actual as they appear on the daily records.

6. Compare cost of a group building project with a comparable boat at a retail boat builders.

7. Take part in launching activities.

BIBLIOGRAPHY:

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AQUACULTURE CURRICULUM

UNIT: Hydraulics

LENGTH: 3 Weeks

WHEN TAUGHT: Grade 11 & 12

OBJECTIVE: Students will be able to:

1. recognize basic principles to hydraulics and how hydraulic systems work.
2. identify the parts of a hydraulic system.
3. compare hydraulic systems.
4. determine the uses of hydraulic systems in aquaculture and marine industries.
5. diagnose a hydraulic system.
6. perform hydraulic maintenance.
7. identify and use hydraulic tools properly.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanic	293-294 (15)
Set Up Mechanic of Farm & Industrial Equipment	298 (2)
Tractor Mechanics Helper	304 (8)
Plant Maintenance Mechanic	358 (2u)

CONTENT:

I. Hydraulic Principles

  A. liquid characteristics
  B. how a hydraulic system works
    1. pump
    2. cylinder
    3. reservoir
    4. check valves
    5. relief valves
    6. control valve

  C. open-center system
  D. closed-center system
  E. variations of open and closed systems

II. Hydraulic Uses

  A. steering systems
  B. brake systems
  C. load sensing
  D. leveling systems
  E. winches
  F. cranes

III. Pumps

  A. displacement
  B. types
  C. efficiency
  D. malfunctions
  E. diagnosing failures

IV. Valves

  A. types
  B. operation
  C. failure and remedies
  D. repair
  E. trouble shooting

V. Cylinders

  A. types
  B. extra features
  C. seals
  D. testing, diagnosing and maintenance

VI. Hydraulic Motors

  A. function
  B. displacement and torque
  C. types
  D. application and efficiency
  E. selection
  F. malfunctions
  G. diagnosing and maintenance

VII. Accumulators

  A. uses
  B. types
  C. servicing and pre-charging

VIII. Filters

  A. the how and why of filters
  B. types
  C. filtration and contamination
  D. maintenance

IX. Hydraulic support systems

A. reservoirs
B. oil coolers
C. hoses
D. pipes, tubes and couplers
E. seals
F. fluids

X. General Maintenance

A. importance of cleanliness
B. safety measures
C. cleaning and flushing
D. filling
E. leaks
F. overheating

XI. Diagnosis and Testing

A. basic steps
B. testing the machine
C. trouble-shooting

TEACHER ACTIVITIES:

1. Use lecture and discussion periods to (1) provide students with theory of hydraulics, (b) acquaint students with hydraulic systems, (c) introduce and demonstrate all practical aspects of hydraulics.

2. Provide students with hand-outs on the functioning of hydraulic systems.

3. Demonstrate the operation of hydraulic systems, maintenance, and repair.

4. Provide actual student experience with actual systems.

5. Prepare shop problems and projects to provide skill training.

6. Provide lab sheets, materials, equipment, references and exams to accomplish objectives.

STUDENT ACTIVITIES:

1. Maintain a notebook on lecture and discussion.

2. Complete lab sheets.

3. Participate in classroom discussion.

4. Perform practical activities on actual equipment.

5. Participate in a practical and written exam.

EVALUATION:

1. All practical projects will be evaluated.
2. Quizzes and written test on all material.
3. Trouble-shooting evaluation.
4. Lab sheets will be evaluated.

RESOURCES:

1. Vo-Ag agricultural mechanics shop.
2. Hydraulic parts and tools.
3. Tractor and equipment.
4. Boat or equipment with hydraulic mechanisms.
5. Reference material.

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1. American Association for Agricultural Engineering and Vocational Agriculture (AAAE & VA), Tractor Hydraulics, Coordinator's Office Agricultural Engineering Building, Athens, Georgia.
2. American Association for Vocational Instructional Material (AAVIM), Hydraulic Systems for Tractors and Other Mobile Equipment, Care & Operation Vol. 1, AAVIM, 120 Engineering Center, Athens, Georgia 30602.
3. Deere & Company, Fundamentals of Service - Hydraulics, Moline, Ill.
4. Owners' Manual

MEDIA:

1. Slide set and tape. Hydraulics (FOC)
2. Overhead transparencies.
3. Hydraulic Parts.
4. Tractors & Equipment.

AQUACULTURE CURRICULUM

UNIT: Independent Aquaculture Project

LENGTH: 8 weeks

WHEN TAUGHT: Grade 12

CONCEPT: A graduate of a vocational curriculum should be prepared to work virtually unassisted to design and complete a given project.

OBJECTIVES: The student will be able to:

1. design, develop, and complete a project in the field of aquaculture.
2. enhance competencies to work with all tools and equipment dealing with boat building, plumbing and hydraulics, net and trap construction, rod and reel repair, etc.
3. do all steps necessary to complete project with limited supervision.
4. develop and live within the budget.
5. maintain all records of the project and determine expenses at all times.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Manager of Grain, Fertilizer, Feed and Seed Sales Business	234 (20, 21
Production Agriculture Mechanic	288-297

CONTENT:

1. Determine project.
2. Draw to scale.
3. Make a budget
    a. monetary
    b. time
4. Purchase supplies
    a. store
    b. record invoices

5. Determine equipment to be used
   a. review operation manuals
   b. review safety procedures
   c. practice safety measures
6. Construct the project
7. Finish the project
8. Analyze Expense Sheet in relation to budget
9. Analyze project in relation to expenses
10. Compare cost of project with a similar product at retail price

TEACHER ACTIVITIES:

1. Work with students to develop projects.
2. Provide instruction and supervision as required.
3. Work with students to analyze finished product and reports.

STUDENT ACTIVITIES:

1. Determine project and draw to scale.
2. Compare price of materials; determine supplier based on cost and quality.
3. Prepare a monetary budget; production time table.
4. Purchase supplies and store.
5. Review manuals and use equipment safely.
6. Construct and finish the project.
7. Determine through analysis the worth of the project.

BIBLIOGRAPHY:

1. Additional research material.
2. Bibliographies from past units.
3. Equipment manuals.
4. Renzulli, J.S., Reis, S.M. and Smith, L.H: The Revolving Door Identification Model, Creative Learning Press, Inc., Mansfield Center, Connecticut 06250; 1981, p. 81-103.

AQUACULTURE CURRICULUM

UNIT: Marine Life IV - Lobstering

LENGTH: 4 weeks

WHEN TAUGHT: Grade 12

CONCEPT: In order to discuss the viability of the lobster industry, it is necessary to study the biological, environmental, and legal aspects of the lobster in Connecticut waters.

OBJECTIVES: The student will be able to:

1. draw and describe the 21 segments of a lobster.
2. distinguish between male and female characteristics.
3. explain the operation of the gills.
4. describe the life of a fertilized egg through larva stage to adult.
5. discuss autotomy.
6. explain lobster development in relation to its environmental surroundings.
7. determine pollutants and predators that affect lobsters.
8. using calipers, determine length of carapace.
9. determine weight of the lobster.
10. discuss legal requirements based on size and equipment.
11. fill out license and catch forms.
12. research and report on the viability of the lobster industry.
13. using skills already learned, construct wood and wire pots to meet legal standards.
14. equip boat with necessary gear.
15. set and tend pots regularly in desirable locations.
16. maintain a quality product.
17. market lobsters.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanic	289 (4)
Retail Fish Cutter	381 (12)
Fish Conservation Officer	475-476 (1, 3, 4, 6, 9, 10)
Fish Hatchery Worker	479 (13, 15, 16)
Fish Research Technician	480-482 (1, 3, 6, 7, 9)
Commercial Fisherman	496-498
Conservation Aide	526-527 (4, 6, 10)
Conservation Officer	529-530 (3, 4, 6, 12)
Wildlife Technician	536-537 (2, 5, 6, 10, 13, 14)

CONTENT:

1. General Characteristics

    a. Homarus americanus
    b. color
    c. Connecticut maturity regulation

2. Cephalothorax

    a. peripods
    b. chelae
    c. tapers

3. Abdomen

    a. pleopods
    b. inopods
    c. telson

4. Male Characteristics

    a. intromitten organ
    b. abdomen
    c. weight at maturity
    d. mating

5. Female Characteristics

    a. pheromone
    b. seminal receptacle
    c. sperm storage
    d. oviducts
    e. abdomen
    f. maturity size

6. Respiration

    a. gills
    b. gill bailers
    c. bubbles
    d. oxygen in relation to water temperature
    e. oxygen in relation to salt

7. Life Cycle

    a. courting
    b. mating
    c. fertilizing
    d. "in berry"
    e. durations
    f. larvae

8. Molting

    a. larvae
    b. plankton nets
    c. 20-25 times
    d. eating habits
    e. effects of light, water temperature, and pressure

9. Autotomy and Regeneration

    a. autotomize
    b. breaking plane
    c. regeneration
    d. relation to size

10. Environment

    a. water temperature and affect on catch
    b. water pressure
    c. salinity
    d. pollutants
    e. communication
    f. shelter
    g. preferred bottom
    h. predators
    i. migration range

11. Legal Regulations for Connecticut

    a. size
    b. sex
    c. licenses
    d. catch reports
    e. ghost pots

12. Fishing Methods

    a. single pots
    b. trawl type
    c. inshore and offshore

13. Fishing Gear Construction

    a. materials
    b. shape
    c. size
    d. escape vents
    e. antighost devices
    f. funnels
    g. bait
    h. ropes and buoys

14. Boats and Other Equipment

    a. size
    b. winches
    c. safety
    d. holding tanks
    e. trawls
    f. refrigeration

15. Economic Importance

    a. annual catch
    b. value
    c. average size of lobster caught

16. Problems

    a. affects of commercial trawling on mortality
    b. lost gear

TEACHER ACTIVITIES:

1. Provide resource materials for the study of the biology of the lobster.

2. Lead discussions of environmental factors.

3. Provide calipers for student's use.

4. Invite a representative from the DEP to discuss legal aspects.

5. At the start of the unit, announce research necessary for report.

6. Provide forms to be completed.

7. Arrange field trips to lobster hatcheries.
8. Arrange with commercial lobsterers for students to gain on-board experience with size and weight.
9. Encourage students to find a lobsterman who will allow on-board handling of pots and catch.
10. Supervise and assist with construction of gear.
11. Supervise while setting and tending pots and selling a quality product.

STUDENT ACTIVITIES:

1. Read assignments and learn the biology of the lobster.
2. Research environment, pollutants, equipment requirements, etc. that affect the lobster industry.
3. Develop competency to determine weight, length, and sex.
4. Accurately complete forms.
5. Construct fishing gear.
6. Set and tend pots.
7. Refrigerate and market catch.
8. Based on field trips and research, write a report on the viability of the lobster industry.
9. Write thank you notes to those who assisted the class.

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AQUACULTURE CURRICULUM

UNIT: Navigation IV--Piloting

WHEN TAUGHT: Grade 12

CONCEPT: "Ability to determine your position quickly and accurately under a wide range of conditions should be one of your primary goals as a skipper." (Piloting, Seamanship & Small Boat Handling; 1974, p. 417).

OBJECTIVES: The student will be able to:

1. discuss the "dimensions" of piloting as learned in previous units.
2. extend the dimensions to include "time" and "heights".
3. exhibit quality competencies to use the instruments of piloting.
4. discuss the standard limits of accuracy.
5. comprehend the concept of "dead reckoning".
6. extend mathematical competencies to include speed curves and vector triangles.
7. determine position in the water quickly and accurately under a wide range of conditions.
8. show mastery competency for all piloting procedures.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Land Use Planning Aide	488 (6)
Land Use Planning Technician	491 (3, 5, 6b, h, i, j)
Commercial Fisherman	496 (3a, b, c, d)

CONTENT:

1. Dimensions of Piloting
    a. direction--true, magnetic, compass
    b. distance--nautical and statute miles
    c. time
    d. speed
    e. position--relative and geographic coordinates
    f. depths
    g. heights--landmarks, bridges, lighthouses, etc.
    h. bearings of landmarks

2. Instruments of Piloting
    a. compass
    b. pelorus
    c. course plotters
    d. course protractors
    e. parallel rulers
    f. drawing triangles
    g. courser
    h. speed calculator

3. Standard Limits of Accuracy
    a. direction
    b. distance
    c. time
    d. speed
    e. position
    f. depths and heights of tides
    g. rounding off numbers

4. Dead Reckoning
    a. terminology
    b. importance
    c. basic requirements
    d. labeling
    e. use of logarithmic scale on charts
    f. speed curves
    g. vector triangles
    h. determine set and drift of current

5. Components of Position Determination
    a. definition of terms
    b. lines of position
    c. visual observations
    d. positioning procedures
    e. electronic piloting
    f. depth information

6. Practice through hypothetical situations.

TEACHER ACTIVITIES:

1. Conduct review sessions of past navigational units as well as any allied units.

2. Supervise mastery of all instruments of piloting.

3. Discuss standard limits of accuracy with class members.

4. Show video tape "Loran C, How It Works"

5. Invite representative of the Coast Guard to lead discussion of Dead Reckoning.
6. Invite Power Squadron members to assist students with mathematical computations.
7. Enlist assistance from the Math Department for any tutorial work.
8. Secure visual aids which would be helpful with speed curves and vector triangles.
9. Secure practice materials for position determination.
10. Review and accept or reject notebooks for completeness.

STUDENT ACTIVITIES:

1. Review past units.
2. Exhibit mastery skills for all piloting instruments.
3. Develop a notebook that includes past units, allied units, and notes from this unit in a coordinated comprehensive manner.
4. Practice mathematical computations, both past and present.
5. Complete practice materials for position determination.

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5. Sufeldt, H.H. & Dunlap, C.D.: Piloting & Dead Reckoning, Naval Institute Press, Annapolis, Maryland.
6. United States Power Squadrons: Boating Course; 1984.

AQUACULTURE CURRICULUM

UNIT: Fish Culture

LENGTH: 4 weeks

WHEN TAUGHT: Grade 12

CONCEPT: To determine the opportunity for financial rewards through the culture of various fish species.

OBJECTIVES: The student will be able to:

1. enhance competencies learned in previous "Culture" units.
2. recognize and identify those species which are found in Connecticut waters.
3. exhibit skills necessary to raise fish in a farm pound.
4. determine those fish that will provide economic reward.
5. discuss management procedures that influence fish production.
6. state laws governing fish production and management.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Catfish Farmer	58-60
Fish Conservation Officer	475-476 (1a, 3, 4, 8, 9)
Fish Hatchery Worker	477-479
Fish Research Technician	480-482
Commercial Fisherman	496-498 (2, 7, 8, 11)
Hunting and Fishing Guide	512 (3, 5)
Conservation Aide	526 (4, 6, 10a, b)
Conservation Officer	529-530 (3, 4, 6, 12)
Wildlife Technician	535-537

CONTENT:

1. Sources of species to stock.
2. Habitat and food supply.
3. Fertilization.
4. Pond Culture
   a. site and construction
   b. water supply and temperature
   c. pH levels
   d. pollutants

5. Stocking
    a. reproduction and growth rates
    b. confinement rearing
    c. breeding and selection
    d. polyculture

6. Controls
    a. water supply and levels
    b. disease
    c. parasite
    d. predators
    e. purging

7. Yields/acre

8. Harvesting Methods and Equipment
    a. legal aspects
    b. problems
    c. specie storage

9. Quality Marketing
    a. inspection
    b. price determines quality
    c. maintaining quality
    d. receiving live
    e. receiving cooked

10. Recipes

Species:

Atlantic shiners
bass
bluegills
carp
catfish
crawfish
eels
frogs
perch
pike
salmon
trout

TEACHER ACTIVITIES:

1. Provide literature, charts, and audio-visual aids.

2. Develop worksheets and handouts.

3. Arrange for resource persons and field trips to state hatcheries.

4. Arrange trips to farm ponds.

5. Provide soft-rayed and spiny-rayed fish for anatomy purposes.

6. Provide equipment and materials for use and leased pond.

STUDENT ACTIVITIES:

1. Compile a notebook of all resource materials.
2. Enhance competencies with equipment used in past "Marine Life" and "Culture" units.
3. Using good practices management, care for and analyze growth in farm ponds.
4. Determine yields/acre for each species.
5. Determine profitability from fertilization through marketing for each species.
6. Write appreciation letters to all who assisted the class.

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AQUACULTURE CURRICULUM

UNIT: Trailering

LENGTH: 4 weeks

WHEN TAUGHT: Grade 12

CONCEPT: Proper knowledge is essential to safely trailer a boat over a road, into the water and out, and store.

OBJECTIVES: The student will be able to:

1. determine proper trailer for various weight boats.
2. choose trailer with appropriate features that are necessary for various needs.
3. identify proper two vehicle features.
4. perform necessary electrical work to hookup lights.
5. determine necessary hitches.
6. practice driving and backing vehicle with trailer.
7. check and maintain vehicle and trailer before, during and after launching.

RELATED JOB TITLES AND RELEVANT COMPETENCIES:

Production Agriculture Mechanic	292-294 (13, 14, 18a-k)
Small Engine Mechanic	311 (5, 6, 7, 8, 9)
Farm Tractor & Equipment Operator	316 (5, 7)
Forestry Aide	542 (6b)

CONTENT:

1. Legal Requirements
2. Features
    a. couplers
    b. winches
    c. supports
    d. rollers
    e. tie-downs
    f. tires
    g. bearing
    h. brakes
    i. lights

3. Tow Vehicles
    a. power
    b. cooling
    c. transmission
    d. brakes
    e. suspension
    f. side mirrors
    g. electrical hookup

4. Hitches
    a. class
    b. weight carrying
    c. tongue weight
    d. safety chains

5. Operation
    a. on the road
    b. at launch site
    c. launching
    d. retrieving
    e. maintenance
    f. through obstacle course

TEACHER ACTIVITIES:

1. Use lecture and discussion periods to acquaint students with safety and proper maintenance.

2. Show safety films.

3. Demonstrate driving and backing techniques.

4. Observe student activities.

5. Provide resource materials.

6. Evaluate performance by quiz and driving skills.

7. Secure Motor Vehicle and insurance permission to allow for this unit.

STUDENT ACTIVITIES:

1. Maintain notebook.

2. Perform routine safety checks and maintenance.

3. Develop competencies to safely launch and retrieve a trailered boat.

4. Develop competencies to discuss all areas and to maintain.

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CATFISH FARMER

Other Titles: Fish Farmer, Fingerling Farmer, Fee Lake Operator, Live Hauler, Fish Farm Worker.

Job Description:

The occupation of Catfish Farmer involves a wide range of activities in the management and operation of farms producing catfish. The size of the farms varies considerably. Responsibilities may depend on the extent of diversification on the farm in producing other crops. Most catfish farmers are self-employed. Examples of the kind of work done may include designing, laying out, and constructing water facilities; securing necessary financial support and budgeting expenditures; managing water; feeding fish; controlling parasites and diseases; selecting and managing breeding stock; spawning and rearing fingerlings; and harvesting, grading, and marketing fish.

Competencies Identified and Validated

N = 32*

Competencies		Weighted Mean**
1.	Establish water facilities.	2.6
a.	Select site for ponds, raceways, etc.	3.4
b.	Plan layout of water facilities.	3.0
c.	Construct ponds.	3.0
d.	Repair damaged water facilities.	3.0
e.	Establish vegetative cover to maintain water facilities.	2.4
f.	Install culture tanks and troughs.	2.4
g.	Construct vats.	2.3
h.	Construct pens and cages.	2.1
i.	Construct troughs.	2.1
2.	Secure water.	3.1
a.	Compute volume of water needed.	3.7
b.	Determine sources of water.	3.3
c.	Conduct water chemistry tests.	3.1
d.	Maintain water pumps.	3.0
e.	Install water pumps.	2.6
3.	Manage water.	3.4
a.	Detect oxygen depletion.	3.9
b.	Correct oxygen depletion problems.	3.8

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* Responses from 32 Catfish Farmers in 14 states. Survey conducted by Department of Agricultural and Extension Education, Mississippi State University, Mississippi State, Mississippi 39762.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

	c.	Control water contamination.	3.5
	d.	Prevent off-flavor in fish.	3.3
	e.	Control aquatic weed growth.	3.1
	f.	Control muddy water.	2.8
4.		Establish farm.	3.4
	a.	Obtain necessary equipment and facilities.	3.7
	b.	Secure needed finances.	3.6
	c.	Budget financial resources.	3.5
	d.	Employ needed labor.	3.4
	e.	Submit required government reports.	2.6
5.		Understand catfish biology.	2.9
	a.	Identify different species of catfish.	2.9
	b.	Identify external parts of catfish.	2.8
6.		Feed catfish.	3.2
	a.	Determine amount to feed.	3.7
	b.	Select form of feed to use.	3.4
	c.	Select methods of feeding.	3.1
	d.	Balance rations.	2.8
7.		Operate equipment.	2.9
	a.	Operate water pumps.	3.3
	b.	Operate aerators.	3.2
	c.	Operate water regulation devices.	3.2
	d.	Operate truck.	3.2
	e.	Operate powered booms for lifting fish.	2.8
	f.	Operate feeding equipment.	2.7
	g.	Operate outboard motorboat.	2.6
	h.	Operate seine haulers.	2.6
	i.	Operate farm tractor.	2.4
8.		Control diseases and parasites.	3.7
	a.	Determine symptoms.	3.8
	b.	Treat fish.	3.8
	c.	Select treatment.	3.7
	d.	Calculate chemical treatments.	3.7
	e.	Diagnose problems.	3.5
9.		Control pests.	3.0
	a.	Control trash fish.	3.3
	b.	Control fish predators (snakes, birds, etc.).	2.9
	c.	Identify trash fish.	2.9
10.		Manage broodfish.	3.3
	a.	Determine sex of catfish.	3.6
	b.	Select broodfish.	3.3
	c.	Calculate number of broodfish needed.	3.3
	d.	Locate sources of broodfish.	3.2
	e.	Improve broodfish stock.	3.1

11.	Spawn fish.	2.9
	a. Establish nests.	3.3
	b. Select fish to spawn.	3.3
	c. Collect egg masses.	3.0
	d. Transport egg masses.	3.0
	e. Observe spawning.	2.5
	f. Control spawning time of fish.	2.2
12.	Hatch eggs.	3.4
	a. Check water temperature.	3.5
	b. Manage artificial hatching facilities.	3.4
	c. Handle egg masses.	3.3
13.	Rear fry.	3.1
	a. Feed fry.	3.5
	b. Handle fry.	3.2
	c. Determine number of fry.	3.0
	d. Determine size of fry.	2.8
14.	Rear fingerlings.	3.1
	a. Feed fingerlings.	3.7
	b. Determine number of fingerlings.	3.1
	c. Determine size of fingerlings.	2.9
	d. Classify fingerlings by length.	2.8
15.	Grow food fish.	3.1
	a. Determine stocking rate.	3.6
	b. Manage open ponds.	3.5
	c. Select fingerlings.	3.4
	d. Manage raceways.	2.7
	e. Manage tanks.	2.5
	f. Manage cages.	2.4
16.	Harvest fish.	3.2
	a. Select method of harvesting.	3.5
	b. Select type of harvest to use (partial or complete).	3.4
	c. Set seine.	3.2
	d. Haul seine.	3.2
	e. Lift fish.	3.1
	f. Use live car.	2.9
17.	Market fish.	3.4
	a. Locate market outlets.	3.5
	b. Select method of marketing.	3.4
	c. Haul fish.	3.3
	d. Grade fish.	3.2
18.	Process fish.	3.4
	a. Establish selling price.	3.9
	b. Check fish for off-flavor.	3.7
	c. Dress fish.	2.6

AGRI-CHEMICAL OCCUPATIONS

AGRI-CHEMICALS MANAGER

Other Titles: Plant Manager, Area Supervisor, Office Manager, Sales Manager, Retail Unit Manager, Plant Superintendent, Lead Operator, Store Manager.

Job Description:

The Manager is responsible for implementing and enforcing policies which will maximize profitability and efficiency for the local retail outlet, through effective sales, maintenance, safety, and distribution programs; hires and dismisses employees; orders and maintains adequate amounts of product; and is ultimately responsible for equipment purchases and repairs. Usually under the supervision of the Regional Sales Representative (or similar title).

AGRI-CHEMICALS FIELD TECHNICIAN

Other Titles: Assistant Manager, Soil and Crop Specialist, Senior Serviceman.

Job Description:

The Field Technician is required to be competent in all operations of the local retail outlet so that they may temporarily substitute for the Manager in all aspects of that job except for major financial matters such as purchasing equipment or product and hiring and dismissing employees.

AGRI-CHEMICALS SERVICE MECHANIC

Other Titles: Service Person, Chief Mechanic, Equipment Manager, Maintenance Supervisor.

Job Description:

The Service Mechanic is responsible for a constant awareness of physical condition of all equipment needed to effectively operate the local retail outlet. This includes being able to operate all blending, handling, application, transferring, and storing equipment; assemble and maintain all such equipment.

Competencies Identified and Validated

Competencies	Weighted Means by Occupation**		
	Manager N = 23 *	Field Technician N=20*	Service Mechanic N = 13*
1. Learn safety rules.	3.4	2.8	2.7
a. Read and obey safety precaution provided on equipment and on packages.	3.8	3.6	3.2
b. Follow an accepted procedure in case of an accident (emergency telephone numbers, first aid center, etc.).	3.8	3.1	3.2
c. Be familiar with information regarding laws and regulations governing the use of chemicals.	3.7	3.0	3.8
d. Determine where and how to store the chemical.	3.7	2.8	2.2
e. Eliminate or minimize safety hazards by instructing employees and customers in safe working procedures.	3.6	3.1	2.5
f. Determine equipment needs for safe disposal of the chemical container.	3.5	2.6	2.5
g. Pass state "Pesticide Safety Licensing".	3.4	3.0	1.7
h. Have knowledge of weight limits and special machinery.	3.3	2.3	3.2
i. Prepare proper proportions of chemical and carrying agents.	3.1	2.8	2.0
j. Place in hospital the books on chemical ingredients and treatment or antidote for poisoning.	3.0	2.2	1.3
k. Select and check respirators for cleanliness, effectiveness, and proper fit.	3.0	2.2	3.0

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* Responses from persons employed in the Agri-Chemical Occupations in five north central states. Survey conducted by Agricultural Education Section, Purdue University, West Lafayette, Indiana 47907.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

Competencies		Manager	Field Technician	Service Mechanic
1.	Check application equipment for leaks, clogged lines, and improper nozzles and/or other malfunctions.	3.0	3.2	3.5
2.	Know soil science relationships.	3.0	3.0	1.6
a.	Recognize weeds in row crops, pastures, forests, and ponds.	3.4	3.3	2.1
b.	Formulate herbicide-fertilizer mixtures.	3.4	2.7	1.5
c.	Identify soil deficiencies from symptoms of growing plants.	3.0	2.8	1.6
d.	Recommend treatment to adjust pH to appropriate levels.	3.0	3.1	1.1
e.	Explain the function of various chemical elements in plant growth.	2.9	2.8	1.7
f.	Determine which surfactants or wetting agents may be best for specific applications.	2.9	2.9	1.6
g.	Take soil samples for chemical analysis.	2.7	3.2	1.8
3.	Understand merchandising products and services.	3.2	2.9	1.6
a.	Recognize a farmer's potential as a producer.	3.7	3.2	1.5
b.	Determine relative amounts of different kinds and types of chemicals to be applied per acre.	3.6	3.3	2.5
c.	Calculate the pesticide and/or application bill for a customer.	3.4	2.8	1.1
d.	Compute costs and returns in determining the use of agricultural chemicals.	3.4	2.9	1.5
e.	Compute amounts of active ingredients of chemicals to be used.	3.4	3.2	1.9
f.	Receive money, prepare necessary records to provide receipts for customers, and provide control.	3.2	3.0	1.6

Competencies	Manager	Field Technician	Service Mechanic
g. Maintain suitable stock inventories and arrangement.	3.2	2.0	1.8
h. Name private and public laboratories and agencies available for analysis and/or consultations.	3.0	2.4	0.9
i. Maintain security of files, merchandise, and equipment.	3.0	3.6	1.6
j. Have a working knowledge of chemical manufacturing.	2.7	2.5	1.5
k. Conduct field trials on new chemicals, and determine profitability and effectiveness.	2.6	2.9	1.6
4. Be able to calibrate equipment.	3.1	3.1	3.1
a. Read and interpret package labels, rate of application, and other methods.	3.5	3.5	2.9
b. Calibrate volume, pressure, and output of equipment.	3.1	3.5	3.4
c. Plan alternative methods of chemical applications.	3.1	3.0	2.2
d. Adjust mixing apparatus to maintain proper solution quality.	3.1	3.1	3.3
e. Describe appropriate applications of various nozzles: flat fan, even fan, flooding, boomless, off center, solid cone, hollow cone, and whirl chamber.	3.0	3.4	3.5
f. Adjust height and width to achieve desired distribution patterns.	3.0	3.1	3.4
g. Use calibration charts to set up the sprayer for adequate coverage.	3.0	3.2	3.2
h. Follow operator's manual for adjustments.	2.9	3.0	3.5
i. Weigh and measure small quanitities of chemicals.	2.9	3.0	2.8

Competencies		Manager	Field Technician	Service Mechanic
5.	Know pest control procedures.	3.2	3.1	2.0
a.	Recognize symptoms of pesticide damage and residues due to error of application or selection of pesticides.	3.5	3.4	2.2
b.	Identify fungi and bacteria on plants and animals and their symptoms.	3.4	3.5	2.4
c.	Consider together, the pest, the hose being attached, and the approved chemicals available, then recommend to the customer the most efficient method, considering environment and control.	3.4	3.3	2.2
d.	Recognize symptoms of insects and nematodes (chewing, sucking, and biting).	3.2	3.3	2.2
e.	Calculate the "economic injury level" for the customer.	3.2	2.9	1.6
f.	Identify common insects, weeds, diseases, and other pests and their damage common to the area.	3.1	3.1	2.3
g.	Recommend treatment for animals and poultry suffering from parasites.	2.9	2.4	0.9
6.	Purchase, maintain, and repair equipment.	2.3	2.5	3.3
a.	Protect company against liability claims by adequate insurance policies.	3.4	2.7	2.2
b.	Call on customers in the slack season to develop sales for the retail outlet.	3.3	3.1	2.3
c.	Inspect all operating equipment according to established procedures and recommend repairs as needed.	3.3	2.6	3.7
d.	Describe characteristics of equipment which affect compatability with chemicals.	3.0	2.8	3.5

Competencies		Manager	Field Technician	Service Mechanic
e.	Use appropriate service equipment and tools needed to maintain or assemble new equipment.	2.9	2.6	3.6
f.	Deliver liquid or dry material to customer operating custom applicating equipment where necessary.	2.9	2.6	2.4

AGRI-CHEMICAL OCCUPATIONS

AGRI-CHEMICALS WAREHOUSE MAN

Other Titles: Assistant Plant Manager, Serviceman, Chemical Warehouseman.

Job Description:

The Warehouseman is responsible for maintaining an accurate inventory at all times; storing compatible chemicals in proper temperature of facility at all times; possess a working knowledge of chemicals' reactivity, volatility, and stability levels; providing for an appealing display area and arrangement; operating and maintaining storage, handling, and transfer of equipment. Usually under the supervision of the Manager and Assistant Manager.

AGRI-CHEMICALS TROUBLE SHOOTER

Other Titles: Assistant Sales Manager, Assistant Sales Representative, Scout.

Job Description:

The Trouble Shooter is responsible for promotion and sale of product and services within assigned area; soil sampling, crop inspection, pesticide performance evaluation, and yield prediction; handling complaints, comments, and suggestions of customers relative to products and services of retail outlets. Usually supervised by Manager.

AGRI-CHEMICALS SALES CLERK

Other Titles: Office Clerk, Store Clerk, Clerk-Typist, Bookkeeper.

Job Description:

The Sales Clerk must be able to: prepare and receive orders from customers; prepare customer invoices; operate weighing equipment; receive money and maintain necessary inventory and financial records; prepare statistical reports for forecast purposes; operate and maintain all office equipment; make recommendations to customers on a limited basis. Sales Clerks are responsible to the Manager.

Competencies Identified and Validated

Competencies	Weighted Means by Occupation** Warehouse Man N = 15*	Trouble Shooter N = 16*	Sales Clerk N = 21*
1. Learn safety rules.	3.2	2.9	2.7
a. Determine where and how to store the chemical.	3.8	3.1	2.5
b. Follow an accepted procedure in case of an accident (emergency telephone numbers, first aid center, etc.).	3.8	3.2	3.2
c. Determine equipment needs for safe disposal of the chemical containers.	3.7	2.7	2.5
d. Read and obey safety precautions provided on equipment and on packages.	3.7	3.5	3.3
e. Eliminate or minimize safety hazards by instructing employees and customers in safe working procedures.	3.7	3.3	3.3
f. Select and check respirators for cleanliness, effectiveness, and proper fit.	3.4	2.2	2.6
g. Pass state "Pesticide Safety Licensing".	3.3	3.3	3.0
h. Be familiar with information regarding laws and regulations governing the use of agrichemicals.	3.3	3.1	3.3
i. Have knowledge of weight limits and special machinery.	2.7	2.8	2.6
j. Prepare proper proportions of chemical and carrying agents.	2.6	3.0	2.5

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* Responses from persons employed in the Agri-Chemical Occupations in five north central states. Survey conducted by Agricultural Education Section, Purdue University, West Lafayette, Indiana 47907.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of some Importance; 1.0 = Not Important; 0 = Does Not Apply.

Competencies	Warehouse Man	Trouble Shooter	Sales Clerk
k. Check application equipment for leaks, clogged lines, and improper nozzles and/or other malfunctions.	2.3	2.9	2.4
l. Place in hospitals the books on chemical ingredients and treatment or antidote for poisoning.	1.7	2.1	1.8
2. Know soil science relationships.	2.2	2.7	2.5
a. Formulate herbicide-fertilizer mixtures.	3.7	2.4	3.0
b. Take soil samples for chemical analysis.	2.7	2.7	2.6
c. Determine which surfactants or wetting agents may be best for specific application.	2.0	2.7	2.2
d. Recognize weeds in row crops, pastures, forests, and ponds.	1.9	2.9	3.0
e. Identify soil deficiencies symptoms of growing plants.	1.8	2.9	2.3
f. Recommend treatment to adjust pH to appropriate levels.	1.6	2.7	2.2
g. Explain the function of various chemical elements in plant growth.	1.5	2.5	2.4
3. Understand merchandising production and services.	2.2	2.3	2.5
a. Maintain suitable stock inventories and arrangement.	3.6	1.8	2.6
b. Maintain security of files, merchandise, and equipment.	2.7	1.8	3.6
c. Recognize a farmer's potential as a producer.	2.6	2.9	2.5
d. Calculate the pesticide and/or application bill for a customer.	2.4	2.7	2.4
e. Determine relative amounts of different kinds and types of chemicals to be applied per acre.	2.2	2.7	3.5

Competencies	Warehouse Man	Trouble Shooter	Sales Clerk
f. Receive money, prepare necessary records to provide receipts for customers, and provide control.	2.1	2.0	3.7
g. Name private and public laboratories and agencies available for analysis and/or consultations.	2.0	2.0	1.8
h. Compute amounts of active ingredients of chemicals to be used.	1.9	2.7	2.7
i. Compute costs and returns in determining the use of agricultural chemicals.	1.8	2.7	2.7
j. Have a working knowledge of chemical manufacturing.	1.6	1.9	2.4
k. Conduct field trials on new chemicals and determine profitability and effectiveness.		2.3	1.7
4. Be able to calibrate equipment.	2.3	3.0	2.6
a. Read and interpret package labels: rate of application, time of application, and alternative methods.	2.9	3.3	3.7
b. Follow operator's manual for adjustments.	2.7	3.1	2.6
c. Calibrate volume, pressure, and output of equipment.	2.5	3.4	2.7
d. Use calibration charts to set up the sprayer for adequate coverage.	2.3	3.5	2.3
e. Plan alternative methods of chemical application.	2.2	3.5	2.3
f. Weigh and measure small quantities of chemicals.	2.1	2.5	2.4
g. Adjust mixing apparatus to maintain proper solution quality.	2.1	2.6	2.0
h. Adjust height and width to achieve desired distribution patterns.	1.7	2.5	2.1

Competencies			Warehouse Man	Trouble Shooter	Sales Clerk
	i.	Describe appropriate applications of various nozzles: flat fan, even fan, flooding, boomless, off-center, solid cone, hollow cone, and whirl chamber.	1.7	3.1	2.4
5.	Know pest control procedures.		1.9	3.1	2.8
	a.	Recognize symptoms of pesticide damages and residues due to error of application or selection of pesticides.	2.4	3.5	3.0
	b.	Identify fungi and bacteria on plants and animals and their symptoms.	2.2	3.4	3.0
	c.	Consider together, the pest, the hose being attached, and the approved chemicals available, then recommend to the customer the most efficient method, considering environment and control.	2.1	3.4	3.2
	d.	Recognize symptoms of insects and nematodes (chewing, sucking, and biting).	1.9	3.3	2.8
	e.	Identify common insects, weeds, diseases, and other pests and their damage common to the area.	1.7	3.2	2.6
	f.	Recommend treatment for animals and poultry suffering from parasites.	1.7	1.7	2.1
	g.	Calculate the "economic injury level" for the customer.	1.5	2.8	2.8
6.	Purchase, maintain, and repair equipment.		2.3	2.5	2.1
	a.	Use appropriate service equipment and tools needed to maintain or assemble new equipment.	2.6	2.9	1.8
	b.	Deliver liquid or dry material to customer operating custom applicating equipment where necessary.	2.5	2.5	2.1

Competencies	Warehouse Man	Trouble Shooter	Sales Clerk
c. Follow greasing and oiling instruction of operator's manual using grease guns and oil cans, packing bearings, etc.	2.5	2.7	2.1
d. Describe characteristics of equipment which affect compatability with chemicals.	2.4	2.5	2.5
e. Inspect all operating equipment according to established procedures and recommend repairs as needed.	2.3	2.7	1.7
f. Repair and maintain sprayer parts, fumigators, and equipment.	1.9	2.5	2.8
g. Repair and/or maintain dusters.	1.7	1.7	1.6
7. Develop managerial abilities.	1.7	2.4	2.8
a. Handle customer complaints within limits established through company channels.	2.8	2.8	3.4
b. Council and advise farmers to assist in increasing their profitability.	2.3	2.7	3.5
c. Call on customers in the slack season to develop sales for the retail outlet.	1.9	2.5	2.6
d. Evaluate and report competitive pricing policies and activities within the area and recommend corrective action.	1.8	2.7	2.3
e. Implement and administer company approved credit and collection policies.	1.2	2.1	3.1
f. Formulate an advertising campaign to promote sale of an agri - chemical product on a broad basis.	0.9	1.9	2.6
g. Protect company against liability claims by adequate insurance policies.	0.9	2.1	2.4

GRAIN, FERTILIZER, FEED AND SEED SALES BUSINESS OCCUPATIONS

COUNTERMAN

Other Title: Salesman.

Job Description: Must have a wide knowledge of farming and ranching and a good understanding of local livestock and crop production practices and problems. Thoroughly familiar with all products which the business stocks for sale. Knows most customers. Fills customer orders and completes record of sales. Keeps inventory of stock on hand and reorders items in short supply. Is usually employed by privately owned firms, businesses, and organizations.

HELPER

Other Title: Worker.

Job Description: A general knowledge of farming and ranching is needed by this employee. He follows instructions of supervisors in filling customers orders, stocks supplies, and assists other employees of the business when his services are needed. He helps to keep buildings clean and orderly, helps load trucks, drives trucks and other equipment used in the business. Is usually employed by privately owned firms, businesses, and organizations.

SALES AND SERVICE REPRESENTATIVE

Other Title: Salesman.

Job Description: A thorough knowledge of farming and ranching is a must for this employee. He should quickly recognize the specific needs of prospective customers and provide them with alternative solutions to their needs which the business he represents can provide. He must have a knowledge of the customer's ability to pay for purchases and the amount of credit which may be offered to various customers. He must have a thorough knowledge of all materials, supplies, and items his company offers for sale, the quantity on hand, their location, and price. He must be considerate with customers and promote good customer relations with the business he represents which is usually privately owned.

BOOKKEEPER

Other Title: Secretary.

Job Description: Must have a general knowledge of farming and ranching. Must have good knowledge of keeping financial accounts and records including purchases, sales, charge accounts, monthly billings, and federal and state tax reporting. Is responsible for inventory control. Must have skill in typing. Is usually employed by privately owned firms, businesses, and organizations.

DRIVER

Other Titles: Truck Driver, Deliveryman.

Job Description: Should have a good general knowledge of farming and ranching. Must be familiar with location of customer's farms and ranches including location of nearby towns and centers of transportation including railroads. Must know how to properly load and unload trucks quickly and safely. Should possess a thorough knowledge of the proper operation and maintenance of trucks, and understand the mechanics of gasoline engines. Must be a skilled and safe driver of trucks and autos; be tactful with customers and promote good customer relations. Must have a good knowledge of all materials and supplies his business sells. Is usually employed by privately owned firms, businesses, and organizations.

Competencies Identified and Validated*

	Weighted Means by Occupation**				
	N 36	N 36	N 41	N 41	N 34
Competencies	Counterman	Helper	Sales & Service Representative	Bookkeeper	Driver
1. Possess desirable personal qualities and qualifications.	3.5	3.3	3.0	3.3	3.1
a. Demonstrate the ability to get along with others.	3.6	3.9	4.0	3.5	3.2
b. Demonstrate the ability to work on his own.	4.0	3.3	2.5	3.4	3.3

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* Responses from persons employed in these occupations or their work supervisors in 16 states. Survey conducted by Department of Agricultural Education, North Dakota State University, Fargo, North Dakota 58102.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

Competencies	Counterman	Helper	Sales & Service Representative	Bookkeeper	Driver
c. Demonstrate a willingness to work.	3.4	3.3	3.7	3.3	3.3
d. Demonstrate the ability to project a desirable image for the firm.	3.5	3.0	3.8	3.3	3.3
e. Demonstrate personal integrity as an employee of the firm.	3.5	3.3	3.8	3.6	3.4
f. Budget time.	3.0	2.6	3.5	3.4	2.9
g. Maintain a satisfactory attendance record.	4.0	3.2	3.4	3.4	3.2
h. Demonstrate desirable job attitude about the organization when working with fellow employees, potential customers and customers.	3.6	3.2	3.6	3.3	3.3
i. Demonstrate a willingness to learn or take supervision.	3.2	3.2	3.4	3.4	3.1
j. Demonstrate the ability to follow directions of supervisor.	2.4	3.4	3.3	3.4	3.2
k. Demonstrate acceptable personal appearance and personal hygiene.	3.1	2.7	3.5	3.3	3.1
l. Schedule jobs.	2.7	2.1	3.3	2.9	2.5
m. Accept routine tasks without becoming disinterested.	2.9	3.0	3.0	2.2	2.9
2. Practice good human relations.	2.9	2.4	2.9	2.6	2.8
a. See and report the customer's point of view.	3.0	2.5	3.4	2.6	2.9
b. Empathize with customer.	2.8	2.3	2.4	2.5	2.6
3. Animal science - nutrition.	1.8	0.6	2.4	0.3	0.5
a. Recommend feeding programs which will eliminate problems of chemical residues in meat, milk and eggs.	1.9	.8	2.7	.3	.6
b. Balance rations for different types of livestock and poultry of various ages.	1.9	.7	2.6	.3	.5
c. Recommend the use of additives and medications in compliance with FDA standards.	2.1	.6	2.7	.3	.5
d. Formulate feeds so as to balance economically grains grown on the farm.	1.9	.7	2.7	.3	.5

Competencies	Counterman	Helper	Sales & Service Representative	Bookkeeper	Driver
e. Explain the purpose of feed additives and medications.	2.2	.8	2.6	.3	.5
f. Determine feed needs in terms of nutrients for growth, production and reproduction.	1.9	.7	2.5	.3	.6
g. Read and explain the meaning of the ingredients listed on a feed tag.	2.1	.9	2.6	.5	.7
h. Recommend feed additives and medication in relation to cost and suitability.	2.1	.6	2.6	.3	.5
i. Evaluate livestock quality and recommend compatible feeding programs.	2.1	.5	2.4	.2	.5
j. Determine suitability of feeds for ruminants, nonruminants.	2.2	.6	2.5	.2	.5
k. Plan alternative feeding programs for different types of livestock using feeds available in the area.	1.9	.5	2.6	.3	.4
l. Substitute various feed ingredients in balancing rations.	1.8	.5	2.4	.3	.5
m. Compute feed required for pound of gain for each major livestock group.	1.8	.5	2.4	.2	.5
n. Classify feeds in terms of nutrients and energy value.	1.7	.5	2.4	.2	.5
o. Determine the form (pelleted, rolled, ground, etc.) in which feeds should be prepared for livestock and poultry.	1.7	.6	2.4	.2	.5
p. Determine the quality of hay and silage in terms of feeding value (judgment, lab analysis, etc.).	1.6	.4	2.5	.2	.5
q. Classify feeds according to mineral content.	1.5	.4	2.2	.3	.5
r. Compute the conversion of nitrogen from non-protein to protein.	1.4	.4	2.3	.4	.5
s. Trace the passage of feed through digestive processes of various animals.	1.3	.4	2.0	.2	.4

Competencies	Counterman	Helper	Sales & Service Representative	Bookkeeper	Driver
t. Analyze feeds for fats, nitrogen-free extract, fiber and ash.	.8	.4	1.6	.3	.4
4. Animal science - animal care and handling.	1.7	.8	2.5	.5	1.0
a. Assist with planning alternative systems of livestock management.	1.6	.5	2.5	.4	.7
b. Identify hazards that may cause fire, injury or poisoning to livestock and poultry.	1.7	1.0	2.4	.5	1.3
5. Animal science - identification and disease control.	1.5	.5	2.3	.2	.5
a. Identify symptoms in animals and birds suffering from deficiencies of essential nutritive elements in feeding rations.	1.4	.7	2.4	.2	.7
b. Identify and plans corrective measures for common livestock diseases and parasites.	1.5	.5	2.4	.2	.5
c. Recommend treatment for animals and poultry suffering from parasites.	1.9	.5	2.4	.2	.5
d. Post animals or birds to determine internal parasites.	1.1	.4	1.8	.2	.3
6. Plant science - general knowledge.	2.2	.9	2.6	1.3	.5
a. Compute weight loss incurred in drying grain.	2.3	1.1	2.3	2.2	.5
b. Compute cost of drying grain.	2.2	1.0	2.3	2.2	.4
c. Recommend accepted crop management practices to improve volume of grain produced.	2.5	.9	3.0	.9	.5
d. Explain crop adaptation in terms of factors related to soil, climate and economics.	2.2	.8	2.8	.6	.5
e. Assist in planning alternative cropping systems.	1.9	.7	2.8	.6	.4
7. Plant science - seed propagation.	1.5	1.1	1.5	.5	.5
a. Analyze seed samples and properly label for sale.	1.5	1.0	1.6	.6	.5
b. Test seed for germination.	1.4	1.2	1.3	.4	.4

Competencies	Counterman	Helper	Sales & Service Representative	Bookkeeper	Driver
8. Plant science - fertilizer.	2.3	.9	2.7	.6	.5
a. Recommend a fertilizer program (timing, placement, etc.).	2.8	.9	3.0	.5	.6
b. Determine relative amounts of different kinds and types of fertilizers to be applied per acre.	2.9	.9	3.1	.6	.6
c. Formulate fertilizer to specification.	2.2	.9	2.4	.7	.5
d. Assist with planning alternative measures of fertilizer applications.	2.3	.9	2.8	.6	.5
e. Substitute fertilizer ingredients according to economic and agronomic conditions.	1.9	.8	2.5	.6	.4
f. Formulate herbicide-fertilizer mixtures.	2.1	.9	2.8	.5	.3
g. Explain the process of manufacturing fertilizers.	1.8	.8	2.2	.5	.6
9. Plant science - hazards (insects, weeds, damage and contamination).	2.3	1.6	2.7	.5	1.0
a. Identify various types of grain damage.	2.6	2.4	2.6	.6	1.1
b. Identify materials that might contaminate grain because of odors.	2.5	2.0	2.5	.6	1.6
c. Identify sources of grain contamination and recommend complete programs of grain sanitation.	2.6	1.6	2.7	.6	1.3
d. Treat grain properly and safely for insect control.	2.1	2.2	2.1	.5	1.2
e. Recommend weed control programs.	2.6	.8	3.1	.6	.6
f. Identify weeds and weed seeds commonly found in crops grown locally.	2.3	1.3	2.9	.4	.7
g. Identify and classify insect damage.	2.1	1.3	2.9	.4	.8
h. Identify seed-borne diseases.	1.9	1.0	2.8	.4	.3

Competencies	Counterman	Helper	Sales & Service Representative	Bookkeeper	Driver
10. Plant science - agricultural chemicals.	2.4	1.1	2.9	.6	.6
a. Recommend proper time to use chemicals (weeds, crops, insects, etc.).	2.9	1.1	3.1	.7	.7
b. Time chemical applications to avoid residue problems.	2.5	1.1	2.9	.6	.6
c. Interpret chemical labels.	2.7	1.3	3.1	.8	.8
d. Compute amounts of active ingredients of chemicals to be used.	2.6	1.2	3.1	.6	.6
e. Recommend insecticides needed.	2.7	1.2	3.1	.6	.5
f. Name sources of information regarding laws and regulations governing the use of agricultural chemicals.	2.4	1.2	2.9	.8	.7
g. Explain the function of various chemical elements in plant growth.	2.1	.9	2.6	.5	.5
h. Weigh and measure relatively small quantities of chemicals.	1.6	1.1	2.1	.5	.7
11. Agricultural mechanics - special equipment maintenance.	2.1	1.7	1.6	.7	1.2
a. Care for and maintain scales.	2.1	1.7	1.6	.7	1.2
12. Agricultural mechanics - equipment, supplies and materials recommendations and selections.	2.1	1.4	2.0	.8	1.1
a. Select proper equipment to combat fire.	1.9	1.9	1.8	1.0	2.1
b. Recommend crop varieties that will maximize returns in terms of yield and market acceptance.	2.5	1.1	3.0	.6	.6
c. Recommend the kinds of equipment commonly needed in a grain, feed, seed and fertilizer facility.	1.8	1.2	2.1	.4	.7
13. Agricultural mechanics - equipment operation - various specialized equipment.	2.1	2.6	1.6	1.0	1.7
a. Weigh grain as it arrives at the elevator.	2.8	2.3	1.9	2.1	2.2

Competencies	Counterman	Helper	Sales & Service Representative	Bookkeeper	Driver
b. Operate seed-treating and seed-cleaning equipment.	1.6	2.5	1.2	.4	1.2
c. Operate and adjust equipment commonly used in a grain, feed, seed and fertilizer facility.	2.0	2.9	1.6	.4	1.6
14. Agricultural mechanics - equipment operation - testing and analysis devices.	2.9	2.5	1.8	1.7	1.1
a. Use balances, moisture testers, screens and dockage machines used in grading grain.	3.1	2.5	2.0	2.1	1.1
b. Operate and read devices for detecting heating of grain in storage (hot spots).	2.6	2.5	1.6	1.3	1.0
15. Agricultural mechanics - equipment operation - major equipment.	2.0	2.0	2.0	.8	1.5
a. Draw a representative sample of grain from a truck or car.	3.1	3.0	1.9	1.6	1.9
b. Calibrate farm implements to apply specific amounts of chemicals.	1.5	1.7	2.2	.4	1.4
c. Recommend and make machinery adjustments which will result in harvesting quality grain.	1.4	1.2	1.9	.3	1.1
16. Agricultural mechanics - equipment operation - office equipment.	3.2	1.6	3.4	3.6	1.8
a. Use the telephone for business transactions.	3.2	1.6	3.4	3.6	1.8
17. Agricultural mechanics - agricultural buildings and convenience - construction.	1.0	.6	1.8	.4	.5
a. Diagram efficient facility layouts for modern grain, feed, seed and fertilizer operations.	.9	.6	1.6	.5	.4
b. Plan and develop mechanical feeding systems.	1.0	.5	1.9	.3	.5

Competencies	Counterman	Helper	Sales & Service Representative	Bookkeeper	Driver
18. Agricultural mechanics - soil and water management - soils.	1.9	1.1	2.4	.5	.5
a. Interpret soil tests.	2.2	1.1	2.8	.7	.5
b. Take soil samples for fertilizer analysis.	1.6	1.7	2.5	.4	.9
c. Recommend treatment to adjust pH to appropriate levels.	2.1	1.2	2.6	.6	.4
d. Explain the importance of soil pH to plant adaptability.	2.3	1.1	2.6	.5	.5
e. Identify soil deficiencies from symptoms of growing plants.	1.9	1.0	2.6	.5	.5
f. Test soils for pH levels.	1.5	.9	2.1	.4	.5
g. Determine the adaptability of soils to crops to be grown.	1.8	1.0	1.7	.4	.4
h. Identify soils problems that may be due to lack of drainage or lack of water.	1.6	1.0	2.5	.4	.5
19. Agricultural business management and marketing - general management.	2.1	1.3	2.5	2.0	.9
a. Understand federal and state laws regarding grain, feed, seed and fertilizer business.	2.7	1.9	3.0	2.5	1.5
b. Understand the legal responsibilities of a business serving the public.	2.7	2.0	3.0	1.7	1.6
c. Develop objectives for the business that can be used by management to promote business growth.	2.0	1.4	2.4	2.0	.8
d. Explain and use contracts and other legal instruments needed in the business operation.	2.2	1.2	2.6	2.5	.6
e. Understand the types of business organization.	2.0	1.1	2.5	2.2	.7
f. Understand the advantages and disadvantages of different types of business organization.	1.9	.9	2.1	2.2	.7
g. Understand and is able to apply the basic requirements for starting a business.	1.5	.8	2.1	2.1	.5
h. Explain how environmental factors affect the feed efficiency of livestock enterprises.	2.0	.9	2.6	.7	.7

Competencies	Counterman	Helper	Sales & Service Representative	Bookkeeper	Driver
20. Agricultural business management and marketing - financial management - analysis and assessment.	1.6	.9	2.2	1.9	.5
a. Prepare and interpret a financial statement for the business.	1.1	1.3	1.7	2.8	.4
b. Understand the sources of capital for each type of business.	1.1	.6	1.6	2.4	.4
c. Estimate customer wants and needs from past records.	2.4	1.2	2.7	2.4	.8
d. Compute costs and returns in determining the use of agricultural chemicals.	2.2	.8	2.6	1.5	.4
e. Develop a hedging program appropriate for a country elevator.	1.1	.6	1.2	1.3	.3
f. Determine from crop reports potential volume of grain produced in elevator trade territory.	1.7	.9	2.1	2.0	.5
g. Analyze costs and returns of such improvement projects as drainage, liming, fertilizers.	1.5	.6	3.2	.8	.4
21. Agricultural business management and marketing - financial management - purchasing and budgeting.	1.4	.6	2.0	1.3	.3
a. Use business goals for preparing a total business budget.	1.3	.7	1.7	2.0	.3
b. Prepares a livestock or poultry feeding budget, estimating feed costs, value of product and return over feed costs.	1.5	.5	2.2	.8	.3
c. Prepare advertising budget.	1.3	.5	1.8	1.6	.3
d. Prepare a budget, estimating costs of production and returns per acre or major crops produced in area.	1.6	.6	2.4	.8	.3
22. Agricultural business management and marketing - financial management - credit.	1.6	.7	2.3	2.1	.4
a. Develop a sound credit policy for a grain, feed, seed and fertilizer business.	1.6	.9	2.0	1.8	.5

Competencies	Counterman	Helper	Sales & Service Representative	Bookkeeper	Driver
b. Evaluate financial statements to determine credit risks of farmers and ranchers.	1.6	.8	2.4	2.3	.4
c. Compute the cost of granting credit.	1.5	.7	2.2	2.2	.4
d. Identify and recommend sources of credit available in the community.	1.7	.5	2.4	2.0	.4
23. Agricultural business management and marketing - financial management - marketing.	1.6	.8	2.1	1.2	.4
a. Determine the possible returns from different methods of selling grain.	1.7	.8	2.1	1.6	.4
b. Explain the relationship of cash grain prices to futures.	1.6	.7	2.1	1.7	.3
c. Locate sources of market information.	1.8	.8	2.1	1.6	.4
d. Interpret market information in market bulletin, newspapers and radio.	1.9	.9	2.3	1.5	.6
e. Understand and is able to apply the basic principles of economics to the distribution and marketing of grain, feed, fertilizer and seed.	1.8	.8	2.4	1.7	.5
f. Identify economic and environmental factors that influence types of livestock and poultry which should be produced in an area.	1.5	.6	2.3	.8	.4
g. Develop a basis chart for various commodities.	1.3	.6	1.4	1.5	.3
h. Conduct a market survey.	1.7	.6	2.2	1.3	.4
i. Assist farmers and ranchers in determining the most economical ways to market livestock.	1.5	.5	2.3	.7	.5
j. Determine when livestock are ready for market.	1.2	.6	2.0	.4	.6
k. Suggest how livestock producers can use the futures market as a market tool.	1.5	.5	2.1	2.4	.6

Competencies	Counterman	Helper	Sales & Service Representative	Bookkeeper	Driver
24. Agricultural business management and marketing - financial management pricing.	2.1	1.2	2.1	2.4	.6
a. Price grain based on grade, weight and quality.	2.1	1.4	2.1	2.4	.7
b. Understand the role of prices in the marketplace.	2.5	1.5	2.6	2.1	.9
c. Compute margins.	2.0	1.0	2.0	2.5	.5
d. Compute markup.	2.1	1.2	2.0	2.5	.5
e. Explain the relationship of markup to margin.	1.7	.9	2.0	2.6	.5
25. Agricultural business management and marketing - financial management - profits.	2.1	1.1	2.6	2.7	1.0
a. Understand how each type of business organization divides its profits or losses.	1.8	.9	2.1	2.6	.8
b. Understand the importance and the function of business profits.	2.4	1.2	3.1	2.7	1.2
26. Merchandising - salesmanship and selling.	3.8	1.4	3.2	1.9	.9
a. Quote grain prices to farmers.	3.3	1.6	3.0	2.7	1.1
b. Close a sale.	3.3	1.4	3.4	2.3	.9
c. Demonstrate the steps of successful selling.	2.7	1.3	3.2	1.8	.8
d. Demonstrate the techniques for successful farm and ranch calls.	2.3	1.4	3.2	1.0	1.0
e. Demonstrate the use of different types of sales techniques (telephone, face-to-face, etc.).	2.9	1.4	3.3	1.6	.9
27. Merchandising - promotion.	2.0	.7	2.7	.7	.5
a. Organize a facility for effective merchandising.	2.3	1.0	2.3	1.1	.5
b. Organize and conduct sales meetings.	1.8	.8	2.9	.7	.5
c. Plan and conduct fertilizer and agricultural chemical demonstrations.	2.2	.8	2.8	.6	.5

Competencies	Counterman	Helper	Sales & Service Representative	Bookkeeper	Driver
d. Plan and carry out promotion days.	2.3	.8	2.8	.8	.5
e. Recognize potential customers identified from market studies.	2.3	.9	2.9	1.1	.8
f. Plan and conduct feeding demonstrations.	1.5	.6	2.7	.5	.5
g. Organize and conduct clinics for customers and staff members.	1.7	.5	2.7	.6	.4
h. Prepare and present demonstrations.	1.8	.7	2.7	.5	.4
i. Prepare and present public speeches.	1.7	.6	2.6	.7	.4
28. Merchandising - displays and advertising.	2.2	.8	2.1	1.0	.4
a. Develop a monthly advertising calendar.	1.9	.6	2.0	1.0	.4
b. Develop displays.	2.4	1.0	2.2	1.0	.4
29. Merchandising - stock control and inventory.	2.4	1.4	1.7	2.3	.8
a. Develop an effective system of inventory control.	2.4	1.4	1.7	2.3	.8
30. Merchandising - quality control.	1.7	1.8	1.6	.9	.8
a. Grade grain according to USDA Grain Standards Act.	2.9	2.1	2.0	1.8	1.0
b. Blend various qualities of grain to meet grade.	2.0	2.5	1.6	.9	1.2
c. Use aeration, drying and turning techniques to preserve grain quality.	1.9	2.6	1.5	.8	1.0
d. Conduct various types of tests to determine protein in grain.	1.1	1.3	1.3	.4	.6
e. Prepare seed to meet state certification laws.	1.2	1.4	1.3	.6	.6
f. Conduct field inspection for producing certified seed.	.9	.9	1.7	.6	.5
31. Merchandising - receiving, packaging and labeling.	1.8	1.3	1.7	1.0	.8
a. Label and market seed in accordance with state laws.	1.7	1.4	1.8	.8	.8

Competencies	Counterman	Helper	Sales & Service Representative	Bookkeeper	Driver
b. Prepare labels for treated seed to meet government regulations.	1.8	1.1	1.6	1.1	.7
32. Merchandising - shipping.	1.3	3.3	1.1	.5	2.7
a. Load cars or trucks with grain for shipment.	1.3	3.3	1.1	.5	2.7
33. Clerical - writing letters and reports.	1.7	.9	2.2	2.3	.7
a. Prepare clear, concise written reports.	2.2	1.3	3.0	3.4	1.2
b. Prepare letters to customers.	2.1	.9	2.6	3.2	.4
c. Write advertising.	1.6	.8	2.1	2.1	.6
d. Prepare news releases.	1.4	.7	1.6	1.5	.6
e. Prepare radio and TV scripts.	1.3	.7	1.8	1.4	.6
34. Clerical - business forms.	2.8	1.6	1.5	3.4	1.0
a. Prepare warehouse receipts.	2.3	1.2	1.3	3.5	.5
b. Prepare scale tickets.	3.0	2.1	1.7	3.6	1.3
c. Write up sales tickets.	3.3	2.0	2.2	3.3	1.3
d. Prepare Bills of Lading.	2.6	1.6	1.3	3.5	1.0
e. Prepare purchase orders.	3.0	1.3	1.7	3.3	.7

PRODUCTION AGRICULTURE MECHANIC

Job Description:

Beginning employees or beginning owners or operators in farming and ranching must make repairs to buildings, facilities, and equipment; and at times construct new equipment, facilities, or buildings according to the needs of their farm or ranch.

Competencies Identified and Validated

N = 107*

Competencies	Weighted Mean**
1. Identify and fit shop tools and equipment.	2.3
a. Identify tools and equipment.	3.0
b. Fit handles in hammers, axes, hatchets, and picks.	2.6
c. Sharpen twist drills.	2.5
d. Fit handles in hoes, rakes, and forks.	2.5
e. Sharpen shovels and hoes.	2.3
f. Sharpen cold chisels and plane blades.	2.3
g. Sharpen screwdrivers.	2.2
h. True grinding wheels.	2.1
i. Sharpen axes, hatchets and picks.	2.1
j. Sharpen auger bits.	2.0
k. Sharpen wood chisels and plane blades.	2.0
2. Maintain and service a home farm shop.	2.5
a. Maintain a clean and orderly shop area.	3.2
b. Place and use fire fighting equipment.	3.1
c. Maintain and service air compressor.	2.6
d. Order and inventory supplies and parts.	2.6
e. Install power driven equipment.	2.5
f. Understand and apply OSHA and/or COSH regulations.	2.4
g. Plan shop layout.	2.4
h. Select shop building.	2.3
i. Inventory tools and equipment.	2.3
j. Select shop site.	2.1
3. Use drawings and blueprints.	2.4
a. Read and interpret drawing.	3.1

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* Responses from 107 Farmers and Ranchers in 20 states. Survey conducted by Agricultural Education Section, Department of Vocational Education, Colorado State University, Fort Collins, Colorado 80523.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

	b.	Apply dimensions to drawings.	2.8
	c.	Figure bills of materials.	2.7
	d.	Read blueprints.	2.0
	e.	Make free hand sketches.	1.9
	f.	Make drawings to scale.	1.9
4.		Learn farm carpentry skills.	2.5
	a.	Drive and remove nails.	3.0
	b.	Operate power saws.	3.0
	c.	Saw to dimension with hand and/or power saws.	3.0
	d.	Bore holes.	2.8
	e.	Set screws.	2.8
	f.	Select appropriate fasteners (nails, hinges, etc.).	2.7
	g.	Select kinds and grades of lumber for a job.	2.7
	h.	Lay out and construct small buildings.	2.6
	i.	Plane to dimension with hand and/or power tools.	2.5
	j.	Use wood chisels.	2.4
	k.	Lay out and cut common rafters.	2.4
	l.	Glue wood.	2.3
	m.	Operate jointer.	1.6
	n.	Operate thickness planer.	1.5
5.		Properly use paint and paint equipment.	2.6
	a.	Clean and store spray gun.	2.9
	b.	Clean and store paint brushes and rollers.	2.9
	c.	Prepare metal surfaces.	2.6
	d.	Prepare wood surfaces.	2.6
	e.	Apply paint with brush or roller.	2.6
	f.	Select paints or preservatives.	2.6
	g.	Apply paint with spray gun.	2.5
	h.	Mask areas prior to painting.	2.5
	i.	Compute area for applying paint or preservatives.	2.4
6.		Operate an arc welder.	2.9
	a.	Practice safety in arc welding.	3.5
	b.	Operate AC welder.	3.4
	c.	Select electrodes.	3.4
	d.	Determine amperage and polarity settings.	3.4
	e.	Strike arc.	3.4
	f.	Prepare metal for welding.	3.3
	g.	Run flat beads.	3.2
	h.	Make butt welds.	3.2
	i.	Make lap welds.	3.2
	j.	Make fillet welds.	3.1
	k.	Run vertical beads.	3.1
	l.	Construct equipment using arc welder.	3.1
	m.	Run overhead beads.	3.0

	n.	Control distortion.	2.9
	o.	Hard surfaces with arc.	2.8
	p.	Operate DC welder.	2.8
	q.	Build up iron parts.	2.7
	r.	Weld cast iron.	2.6
	s.	Punch holes.	2.5
	t.	Cut with arc.	2.5
	u.	Heat with carbon arc torch.	2.3
	v.	Braze with carbon arc torch.	2.2
	w.	Weld aluminum.	2.2
	x.	Operate metal inert gas (MIG) welder.	2.0
	y.	Operate tungsten inert gas (TIG) welder.	1.7
7.	Operate an oxy-acetelyne welder.		3.0
	a.	Check for leaks.	3.4
	b.	Shut off equipment.	3.4
	c.	Turn on equipment.	3.4
	d.	Adjust pressure regulator.	3.3
	e.	Change cylinder.	3.3
	f.	Light and adjust flame.	3.3
	g.	Cut with cutting torch.	3.3
	h.	Clean tips.	3.3
	i.	Choose proper tip size.	3.2
	j.	Run bead with rod.	3.0
	k.	Braze thin metal.	3.0
	l.	Apply hard surfacing material.	3.0
	m.	Run flat beads.	2.9
	n.	Braze cast iron.	2.9
	o.	Make butt weld.	2.8
	p.	Make fillet welds.	2.8
	q.	Build up iron parts with bronze.	2.8
	r.	Make lap welds.	2.8
	s.	Run vertical beads.	2.7
	t.	Run bead without rod.	2.7
	u.	Run overhead beads.	2.6
8.	Perform skills for hot and cold metal work.		2.4
	a.	Cut thread with tap and die.	3.0
	b.	Drill holes.	3.0
	c.	Use files.	2.9
	d.	Identify metals.	2.8
	e.	Cut with tin snips.	2.8
	f.	Solder metal.	2.7
	g.	Cut with cold chisel.	2.7
	h.	Cut with hand hack saw.	2.6
	i.	Bend metal.	2.6
	j.	Use and maintain soldering copper.	2.5
	k.	Use power hack saw.	2.4
	l.	Form sheet metal joints.	2.3
	m.	Anneal, harden, and temper metal.	2.3
	n.	Draw-out metal.	2.1

o.	Up-set metal.	1.9
p.	Operate metal-working lathe.	1.8
q.	Operate gas forge.	1.5
r.	Operate coal forge.	1.3
9.	Learn skills for concrete and masonry work.	2.5
a.	Pour concrete.	2.8
b.	Trowel concrete.	2.8
c.	Protect concrete while curing.	2.8
d.	Reinforce concrete.	2.8
e.	Mix concrete.	2.8
f.	Build and prepare forms.	2.7
g.	Remove forms.	2.7
h.	Embed bolts.	2.7
i.	Edge concrete.	2.6
j.	Drill holes in concrete.	2.5
k.	Treat forms.	2.4
l.	Lay concrete blocks.	2.3
m.	Test aggregates for impurities.	2.1
n.	Lay brick.	1.9
10.	Operate and maintain farm engines.	3.3
a.	Change oil and oil filters.	3.6
b.	Service air and fuel filters.	3.6
c.	Maintain battery water.	3.6
d.	Start and operate both gas and diesel engines properly.	3.6
e.	Read and follow operator's manuals.	3.5
f.	Remove and connect battery cables.	3.5
g.	Charge batteries.	3.4
h.	Troubleshoot and identify fuel problems.	3.3
i.	Troubleshoot and identify ignition problems.	3.3
j.	Maintain and operate small gas engines (2 and 4 cycle).	3.1
k.	Identify engine components and systems.	3.1
l.	Determine voltage of batteries.	3.0
m.	Read battery hydrometer.	3.0
11.	Learn minor tuneup and repairs for farm engines.	2.5
a.	Clean, gap, and replace spark plugs.	3.5
b.	Clean, install, and gap breaker points.	3.3
c.	Install condensors.	3.3
d.	Adjust carburetor mixture and speed screws.	3.0
e.	Time engines using timing light.	2.9
f.	Set float levels in carburetors.	2.8
g.	Disassemble and reassemble distributors.	2.7
h.	Set breaker point dwell using a dwell meter.	2.7
i.	Measure compression.	2.6
j.	Adjust valves.	2.6

k.	Measure vacuum.	2.6
l.	Replace solenoids and bendix gears.	2.5
m.	Clean brush holders and install brushes.	2.4
n.	Disassemble and clean starting motors.	2.4
o.	Test and replace coils.	2.3
p.	Test fuel pumps.	2.3
q.	Rebuild carburetors.	2.3
r.	Clean commutator bars.	2.1
s.	Operate distributor testing machine.	2.1
t.	Test injector on diesel engines.	2.1
u.	Repair alternators.	2.0
v.	Test generator with growler.	1.9
w.	Operate exhaust analyzer.	1.6
12.	Overhaul and repair farm engines.	2.2
a.	Torque cylinder head bolts.	2.5
b.	Replace pan and gasket assemblies.	2.4
c.	Overhaul engines.	2.4
d.	Remove and inspect cylinder heads.	2.4
e.	Install and torque main bearings and rod caps.	2.3
f.	Assemble and install cylinder heads.	2.3
g.	Remove piston assembly.	2.3
h.	Hone cylinders.	2.3
i.	Replace piston rings.	2.2
j.	Install oil pump.	2.2
k.	Ream cylinder ridge.	2.2
l.	Install timing gear and/or chains.	2.2
m.	Install piston assembly.	2.2
n.	Determine valve stem guide clearance.	2.2
o.	Replace rocker arms.	2.2
p.	Check piston ring end gap.	2.2
q.	Install crankshaft.	2.2
r.	Measure ring band clearance.	2.2
s.	Replace valve guides.	2.2
t.	Grind valves; reface valves and valve seats.	2.2
u.	Measure cylinder taper and roundness.	2.1
v.	Replace hydraulic valve lifters.	2.1
w.	Use plastigage, micrometers, and other measuring devices to determine wear and/or clearance.	2.1
x.	Test valve springs.	2.1
13.	Operate and maintain trucks and tractors.	3.2
a.	Keep fuel and lubricants clean.	3.6
b.	Operate tractors (wheeled).	3.6
c.	Maintain oil level in tractor hydraulic systems.	3.6
d.	Lubricate trucks and tractors.	3.6
e.	Test anti-freeze.	3.4
f.	Service cooling systems.	3.3
g.	Repack and adjust front wheel bearings.	3.2

h.	Adjust brakes.	3.2
i.	Service tires.	3.2
j.	Adjust clutches.	3.1
k.	Load and unload trucks by hand or with mechanical devices (hoists, lifts, winches, etc.).	3.1
l.	Install wheel weights.	2.9
m.	Remove and mount tractor tires.	2.9
n.	Adjust steering mechanisms.	2.9
o.	Operate tractors (tracked).	2.4
14.	Make minor repairs on trucks and tractors.	2.6
a.	Check and replace water hoses.	3.2
b.	Pack wheel bearings.	3.2
c.	Test and replace fan belts.	3.2
d.	Replace thermostats.	3.1
e.	Clean radiators and cooling systems.	3.0
f.	Replace water pumps.	3.0
g.	Replace oil seals.	3.0
h.	Bleed brake lines.	3.0
i.	Install brake linings.	2.8
j.	Replace voltage regulators.	2.8
k.	Test radiator pressure caps.	2.7
l.	Adjust voltage regulators.	2.5
m.	Service power steering units.	2.5
n.	Service engine governor and linkage.	2.5
o.	Operate steam cleaner or high pressure cleaner.	2.4
15.	Learn the hydraulic systems of trucks and tractors.	2.6
a.	Stop leaks in hydraulic systems.	3.1
b.	Clean hydraulic system breather cap or air vent.	3.0
c.	Drain, clean, flush, and refill hydraulic system.	3.0
d.	Clean and replace hydraulic lines.	3.0
e.	Replace hydraulic "O" rings.	2.9
f.	Replace hydraulic fittings.	2.9
g.	Troubleshoot hydraulic systems.	2.9
h.	Install hydraulic hose connections.	2.9
i.	Bleed hydraulic systems.	2.8
j.	Maintain hydraulic cylinders.	2.8
k.	Clean hydraulic system orifices.	2.7
l.	Clean hydraulic relief valves.	2.5
m.	Analyze malfunctions of hydraulic pumps.	2.5
n.	Service and repair external hydraulic pumps.	2.5
o.	Repair hydraulic cylinders.	2.5
p.	Service hydraulic motors.	2.4
q.	Determine hydraulic cylinder lift force.	2.2
r.	Repair hydraulic motors.	2.2
s.	Operate a hydraulic tester.	2.2

	t.	Service and repair internal hydraulic pumps.	2.2
	u.	Determine hydraulic cylinder displacement.	2.1
16.		Operate and maintain farm machinery.	3.2
	a.	Read and follow operators' manuals.	3.6
	b.	Know and comply with safety rules relating to the operation of each piece of farm machinery.	3.6
	c.	Make operating adjustments.	3.5
	d.	Hitch implements.	3.4
	e.	Adjust V-belts for tension.	3.4
	f.	Repair equipment under field conditions.	3.4
	g.	Clean planting equipment.	3.4
	h.	Lubricate field machines.	3.3
	i.	Clean fertilizer equipment.	3.3
	j.	Replace bearings and races.	3.3
	k.	Read and follow technical service manuals.	3.3
	l.	Repair roller and hook-link chains.	3.2
	m.	Operate field machines.	3.1
	n.	Recondition worn equipment.	3.1
	o.	Calibrate field machines.	3.1
	p.	Troubleshoot machines.	2.8
	q.	Store equipment.	2.7
	r.	Assemble new machinery.	2.7
	s.	Construct machinery and equipment.	2.7
	t.	Determine field efficiency of machines.	2.6
17.		Repair power systems.	3.0
	a.	Attach and maintain P.T.O. shaft.	3.3
	b.	Adjust belt tension.	3.2
	c.	Service shafts and universal joints.	3.2
	d.	Adjust sprocket chains and wheels.	3.1
	e.	Adjust belts and pulleys for proper speed.	3.1
	f.	Size and replace belts/V belts.	3.1
	g.	Service flexible shafts.	3.0
	h.	Measure shaft R.P.M. with a tachometer.	2.6
	i.	Splice flat belts.	2.1
18.		Learn rural electrification skills.	2.9
	a.	Use safety measures in electrical wiring.	3.5
	b.	Select correct fuse sizes.	3.2
	c.	Replace fuses.	3.2
	d.	Make splices.	3.0
	e.	Repair electrical cords.	3.0
	f.	Wire on-off switches.	2.9
	g.	Select wire sizes.	2.9
	h.	Know electrical terminology such as: volts, amps, watts, ohms.	2.9
	i.	Attach wires to terminals.	2.9
	j.	Solder splices.	2.8

k.	Install wire nut connectors.	2.8
l.	Install light fixtures.	2.8
m.	Install electric motors.	2.8
n.	Wire buildings and structures.	2.6
o.	Wire three-way switches.	2.6
p.	Wire four-way switches.	2.3
19.	Operate and maintain electric motors.	2.5
a.	Start and stop large electric motors properly to prevent damage to pumps, grinders, mixers, etc.	2.9
b.	Maintain electric motors.	2.8
c.	Identify and select electric motors.	2.7
d.	Figure electric motor pulley size and speeds.	2.5
e.	Change direction of rotation of electric motors.	2.4
f.	Check amperage draw under load.	2.4
g.	Change electric motors from 120 volts to 240 volts or vice versa.	2.2
h.	Repair electric motors.	2.1
20.	Learn home convenience and sanitation skills.	2.6
a.	Repair leaky faucets.	2.9
b.	Assemble pipe and pipe fittings.	2.9
c.	Thread pipe.	2.9
d.	Measure and cut pipe.	2.9
e.	Cut plastic tubing/pipe.	2.9
f.	Install plastic tubing/pipe.	2.9
g.	Flare copper tubing.	2.8
h.	Cut copper tubing.	2.8
i.	Ream pipe.	2.8
j.	Install fixtures on plastic pipe.	2.8
k.	Sweat joints on copper pipe.	2.6
l.	Adjust air control mechanism on pressure system.	2.5
m.	Install pressure pumps.	2.5
n.	Cut soil pipe.	2.4
o.	Install water heaters.	2.4
p.	Repair pumps.	2.4
q.	Caulk joints on soil pipe.	2.3
r.	Lay soil pipe.	2.2
s.	Cut and install glass.	2.2
t.	Measure, cut, and install fiberglass or plexiglass.	2.2
u.	Service septic tanks.	2.1
21.	Use surveying equipment and do surveying.	2.3
a.	Measure fields with wheels, tapes, chains, or A-frames.	2.6
b.	Set up the farm level.	2.5

c.	Read surveying rod.	2.4
d.	Lay out lines to grade.	2.4
e.	Determine elevations with farm level.	2.4
f.	Lay out building foundations with farm level.	2.4
g.	Measure slope with farm level.	2.3
h.	Read contour maps.	2.3
i.	Lay out contour lines.	2.2
j.	Make contour maps.	1.8
22.	Perform skills used in irrigation and drainage.	2.2
a.	Start irrigation pump.	2.5
b.	Set up and move irrigation pipe.	2.4
c.	Pack and adjust packing glands on pump.	2.4
d.	Measure water through gates or weirs.	2.3
e.	Calculate amount of water applied.	2.3
f.	Repair sprinkler heads.	2.3
g.	Lay out irrigation systems.	2.2
h.	Install drainage tile.	1.9
i.	Construct terraces.	1.8
j.	Construct reservoirs.	1.7
23.	Build and repair farm fences.	3.1
a.	Brace corner posts.	3.3
b.	Repair fences.	3.3
c.	Stretch wire.	3.3
d.	Secure wire to posts.	3.2
e.	Splice wire.	3.2
f.	Set posts.	3.2
g.	Build wire gates.	3.2
h.	Set steel posts.	3.2
i.	Dig post holes.	3.1
j.	Lay out fence lines.	3.1
k.	Anchor fence lines.	3.1
l.	Trouble shoot electric fences.	3.0
m.	Install electric fences.	3.0
n.	Install manufactured gates.	3.0
o.	Install fences across water gaps and ditches.	3.0
p.	Use power posthole digger.	2.9
q.	Treat fence posts.	2.3
24.	Repair and construct farm buildings.	2.8
a.	Repair farm buildings.	3.1
b.	Evaluate existing buildings for repairs or remodeling.	2.9
c.	Estimate costs of new buildings.	2.7
d.	Construct or assist in constructing large buildings.	2.7

e.	Plan new buildings.	2.7
25.	Repair and construct livestock equipment.	2.5
a.	Construct livestock handling equipment.	2.8
b.	Use and maintain livestock spraying equipment.	2.8
c.	Maintain and sharpen clippers and shears.	2.4
d.	Clean, oil, and preserve leather.	2.3
e.	Make rope halters.	2.2

SETUP MECHANIC OF FARM AND INDUSTRIAL EQUIPMENT

Other Titles: Farm Mechanic, Field Equipment - Farm Maintenance Mechanic.

Job Description:

Services, adjusts, and makes minor repairs on farm vehicles, machinery, and equipment, such as tractors, trucks, automobiles, harvesters, combines, silo fillers, plows, and similar equipment. Using hand tools: observes and examines machinery and parts in operation to detect malfunctioning or defective units. Replace component, such as carburetors, fuel pumps, generators, ignition points, and spark plugs. Adjusts timing of motors, lubricates, washes, paints, and cleans vehicles and attachments. May assist other workers in more complex maintenance tasks, such as overhaul of machinery and equipment, repair and erection of buildings and structures, plumbing repair, and electrical work on the farm.

Competencies Identified and Validated

N = 29*

Competencies	Weighted Mean**
1. Maintain and service power machinery systems.	
a. Change oil and filter.	3.6
b. Check coolant freezing point.	3.6
c. Lubricate all types of equipment.	3.5
d. Service air cleaners, dust unloading valves and precleaners.	3.3
e. Service or replace batteries and cables.	3.2
f. Recommend oils and lubricants for all types of machinery.	3.1
g. Prepare cooling system for cold weather.	3.1
h. Demonstrate safety rules for handling tractor fuel.	3.0
i. Identify sources of contamination of oil.	2.7
j. Describe operation of hydrostatic transmission.	2.2
2. Repair hydraulics.	
a. Remove, clean, and replace hydraulic filters.	3.3
b. Recommend schedule for replacing filters.	2.9
c. Remove and replace telescoping hydraulic cylinders.	2.8

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* Responses from 29 Farm Equipment Dealerships in 4 states. Survey conducted by Department of Agricultural Education, University of Missouri, Columbia, Missouri 65201.

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3. Maintain and adjust planting equipment systems.

a.	Calibrate planter for row width and population.	3.2
b.	Remove and replace furrow openers.	2.8
c.	Set up grain drill delivered from factory.	2.7
d.	Prepare grain drill for storage.	2.7
e.	Adjust planter to different planting depths.	2.6
f.	Install fertilizer hose.	2.5
g.	Set up planter delivered from factory.	2.4
h.	Select and install correct seed plates.	2.4
i.	Calibrate hydraulic transport and leveling system.	2.4
j.	Clean and service planters for storage.	2.4
k.	Recommend seed drum for specific conditions.	2.3
l.	Service and adjust fluted and double run feed drills.	2.3
m.	Recommend speed at which planter is to be driven.	2.2
n.	Install and service no-till coulters.	2.2
o.	Repair and adjust fertilizer drill.	2.2
p.	Prepare drill and seeder for storage.	2.2
q.	Calibrate planter fertilizer rate.	2.1
r.	Install and calibrate herbicide and insecticide attachments.	2.1
s.	Install grass seed attachment.	2.1
t.	Repair and adjust grass seeder.	2.0
u.	Test accuracy of acremeter.	1.9

4. Maintain and adjust tillage equipment systems.

a.	Set up plow delivered from factory.	3.2
b.	Assemble cultivator.	3.1
c.	Align sweeps for proper tillage.	3.1
d.	Adjust for proper trailing and furrow filling.	3.1
e.	Service and adjust tamden disc.	3.0
f.	Adjust attachments for best tillage situation.	2.9
g.	Set up folding gangs.	2.8
h.	Set up carrier for cultivators.	2.7
i.	Recommend tool arrangement.	2.6
j.	Set up spring or spike tooth harrow.	2.6
k.	Set up rotary hoe.	2.6
l.	Prepare plow for storage.	2.5

5. Maintain and adjust combine systems.

a.	Adjust cylinder and concave.	3.0
b.	Troubleshoot thrashing system.	2.9
c.	Adjust straw walkers.	2.9
d.	Inspect and repair sickle bar, knives, guards, and wear plates.	2.9
e.	Clean and service grain and tailing elevators.	2.8

	f.	Adjust and service boot grain supply augers.	2.8
	g.	Adjust and service cleaning unit.	2.8
	h.	Inspect and service separating unit.	2.8
	i.	Attach platform and grain feeder to separator.	2.8
	j.	Adjust auger height.	2.7
	k.	Remove and replace unloading auger.	2.7
	l.	Adjust rear axle to desired width.	2.6
	m.	Adjust reel speed to specific crop condition.	2.4
	n.	Condition combine for storage.	2.4
	o.	Troubleshoot cutting problems.	2.3
6.	Maintain and adjust forage harvesting systems.		
	a.	Time the baler and test by hand.	2.9
	b.	Service and adjust knotter.	2.8
	c.	Assemble baler shipped from factory.	2.7
	d.	Adjust shear bar to specification.	2.7
	e.	Align and adjust cutting bar.	2.6
	f.	Remove and replace sickle knives, guards, and wear plates.	2.5
	g.	Adjust or replace lifting mechanism.	2.5
	h.	Service or replace shearing safety mechanism.	2.5
	i.	Remove and replace cylinder knives.	2.5
	j.	Replace rake teeth.	2.4
	k.	Install and adjust swath deflectors.	2.4
	l.	Clean and lubricate baler for storage.	2.4
	m.	Inspect and service auger.	2.4
	n.	Install and service bale injector.	2.4
	o.	Adjust tying mechanism or wire tie.	2.4
	p.	Service and repair twine wrapping mechanism.	2.4
	q.	Set up table for efficient cleaning.	2.4
	r.	Service hydraulic bale compression system.	2.3
	s.	Adjust for correct bale density and diameter.	2.3
	t.	Recommend correct tensions for baler.	2.3
	u.	Repair or replace forage deflects.	2.3
	v.	Recommend adjustment for adequate cleaning of ground.	2.2
	w.	Adjust or replace inner or outer mower shoe.	2.2
	x.	Install wagon hitch or baler.	2.1
	y.	Install or repair bale counter.	2.1
	z.	Service and adjust pickup conveyor.	2.1
	aa.	Align by strippers with rake teeth.	2.0
	bb.	Adjust reel speed.	2.0
7.	Perform general shop tasks.		
	a.	Read and assemble machinery from drawings.	3.6
	b.	Identify parts from drawings.	3.6
	c.	Set up machines using shop manual.	3.4
	d.	Preservice machinery.	3.3
	e.	Fill out a job ticket.	3.2
	f.	Operate a steam cleaner and a high pressure washer.	3.2

g.	Check shipping invoice from drawings.	3.1
h.	Attach and read an electric tachometer.	3.1
i.	Pickup and deliver machinery.	3.0
j.	Cut and heat with oxyacetylene welder.	2.7
k.	Sketch a layout from designed plans.	2.6
l.	Select welding electrode for specific jobs.	2.6
m.	Butt and fillet weld in all positions with arc welder.	2.4

8. Maintain shop safety.

a.	Wear eye and hearing protection.	3.9
b.	Use power hand tools safely.	3.8
c.	Store combustible materials safely.	3.8
d.	Install and adjust safety guards on machinery.	3.7
e.	Use high pressure fluids safely.	3.7
f.	Store chemicals correctly.	3.6
g.	Ventilate engine while running.	3.5
h.	Select proper fire extinguisher for type of fire.	3.5
i.	Administer first aid prior to medical treatment.	3.4
j.	Use standard hand signals in high noise areas.	3.4
k.	Read and interpret safety signs, symbols, and color codes.	3.4
l.	Provide adequate lighting.	3.3
m.	Use compressed air safely.	3.0

TRACTOR MECHANICS HELPER

Job Description:

Tractor Mechanics helper assists tractor mechanic in repairing tractors and tractor components, using hand tools: installs jacks and hoists to raise equipment and lift dismantled assemblies. Disassembles and assembles tractor parts, using machines, hand tools. Clean tools and parts with naphtha, gasoline, or other cleaning compounds. May wash and lubricate equipment. Performs other duties as described under helper.

Competencies Identified and Validated

N = 32*

Competencies	Weighted Mean**
1. Maintain and repair engine system.	
a. Remove and replace rings.	4.0
b. Time internal components.	3.4
c. Remove and replace cylinder head.	3.1
d. Inspect and clean cylinder block.	3.1
e. Remove and replace crankshaft bearing.	3.1
f. Remove and replace main bearings.	2.9
g. Inspect milled surfaces of cylinder block and head.	2.8
h. Remove and replace sleeve.	2.8
2. Maintain and repair electrical system.	
a. Clean, gap, and test spark plugs.	2.9
b. Set ignition timing.	2.8
c. Service or replace battery cables.	2.8
d. Inspect secondary circuit leaks, plug wires, distributor caps, and rotor.	2.6
e. Diagnose spark plug conditions and recommend head ranges.	2.3
f. Replace windshield wiper mechanisms or controls.	2.3
g. Strobe distributor and modify or correct advance curve.	1.8
3. Maintain and repair fuel delivery system.	
a. Adjust carburetor for load.	3.4
b. Install carburetors.	2.8

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c.	Bleed air from diesel fuel system.	2.8
d.	Adjust carburetor for idle.	2.7
e.	Test pressure of transfer pump.	2.7
f.	Test injector for opening pressure.	2.6
g.	Adjust carburetor for best fuel economy.	2.5
h.	Clean carburetor.	2.5
i.	Repair or replace gasoline carburetor.	2.5
j.	Test injector for valve seat leakage.	2.4
k.	Test injector for spray pattern.	2.4
l.	Test injector for nozzle leak back.	2.4
m.	Repair and replace fuel injector.	2.4
n.	Adjust floating setting to specification.	2.3
o.	Install and time the injection pump.	2.3
p.	Adjust governor.	2.3
q.	Repair and replace injector nozzle.	2.2
r.	Troubleshoot gasoline carburetor problem.	2.1
s.	Diagnose injector problems.	2.1
t.	Clean, inspect, and diagnose wear of injector nozzle.	2.1
4.	Maintain and repair intake and exhaust systems.	
a.	Remove and replace valves.	2.8
b.	Remove and replace rocker arm.	2.6
c.	Inspect and replace valve spring.	2.4
d.	Inspect and replace can followers.	2.4
e.	Inspect and replace valve rotators.	2.3
f.	Recondition valve face and seat.	2.3
g.	Diagnose turbochargers - superchargers problems.	1.7
h.	Inspect and replace turbocharger impeller.	1.5
i.	Measure bearing clearance of turbocharger.	1.4
5.	Maintain and repair lubrication system.	
a.	Test engine oil pressure.	2.9
b.	Service crankcase ventilation system.	2.6
c.	Repair and replace crankcase ventilation system.	2.6
d.	Test oil relief pressure valve.	2.4
e.	Inspect and replace bushings and bearings.	2.4
f.	Clean and adjust pressure regulating valve.	2.3
g.	Identifying and diagnosing oil pressure problems.	2.3
h.	Diagnose lubrication system failure.	2.1
i.	Identify sources of contamination of oil.	2.1
6.	Maintain and repair cooling system.	
a.	Identify internal coolant leakage.	2.3
7.	Maintain and repair mechanical transmission system.	
a.	Separate engine from clutch housing.	3.2
b.	Align transmission with engine.	2.8
c.	Adjust clutch linkage.	2.8
d.	Replace oil seals and oil slinger rings.	2.6

e.	Remove and replace spring-loaded clutch.	2.6
f.	Remove and replace bearings.	2.5
g.	Remove and replace bushings.	2.5
h.	Remove and replace worn or scuffed gears.	2.5
i.	Clean splines and test for wear.	2.4
8.	Repair hydraulics.	
a.	Remove and replace seals in the hydraulic system.	2.6
b.	Test opening pressure of valves.	2.5
c.	Troubleshoot malfunction of cylinder.	2.4
d.	Remove and replace pressure control valves.	2.3
9.	Maintain and repair brake system.	
a.	Remove and replace disk brakes assembly.	2.5
10.	Maintain and repair final drive system.	
a.	Adjust pinion mesh according to specifications.	3.0
b.	Remove and replace seals in final drive.	2.6
c.	Remove and replace axle.	2.6
d.	Replace pinion and ring gear in final drive.	2.3
e.	Troubleshoot cause of excessive wear on final drive.	2.1
f.	Adjust backlash in final drive.	2.0
11.	Perform general shop tasks.	
a.	Safely store combustible materials.	3.4
b.	Heat with oxyacetylene.	3.2
c.	Set up and operate dynamometer.	3.0
d.	Take measurement and read micrometer.	2.9
e.	Fusion weld with oxyacetylene.	2.8
f.	Recondition and sharpen hand tools.	2.8
g.	Take measurement and read dial indicator.	2.8
h.	Attach and read dwell meter.	2.7
i.	Take measurement and read plastigauge.	2.7
j.	Remove broken stud bolts.	2.7
k.	Butt weld with electric arc.	2.3
l.	Fillet weld with electric arc.	2.3
m.	Select welding electrodes for specific jobs.	2.2
n.	Vertical weld with electric arc.	2.2
o.	Weld cast iron with oxyacetylene.	2.2
p.	Cut with oxyacetylene.	2.2
q.	Horizontal weld with electric arc.	2.0
r.	Over head weld with electric arc.	2.0
s.	Ink gears and determine tolerance.	2.0
t.	Braze with oxyacetylene.	1.9
u.	Cut with electric arc.	1.8
v.	Use safety procedures with welding.	1.8

12. Maintain shop safety.

a.	Read and interpret color codes.	3.8
b.	Store chemical correctly.	3.8
c.	Use power hand tools safely.	3.6
d.	Use compressed air safely.	3.6
e.	Use personal protective equipment.	3.5
f.	Provide adequate lighting.	3.5
g.	Wear eye protection.	3.5
h.	Store combustable material safely.	3.4
i.	Select proper fire extinguishers for type of fire.	3.4
j.	Read and interpret safety signs and symbols.	3.3
k.	Ventilate engines while running.	3.3
l.	Install and adjust guards on equipment.	3.3
m.	Install and adjust guards on machinery.	3.3
n.	Administer first aid prior to medical treatment.	2.9
o.	Use standard hand signals in high noise areas.	2.9
p.	Wear hearing protection.	2.8
q.	Test electrical circuits and switches.	2.5

PARTSMAN IN FARM MACHINERY DEALERSHIP

Other Titles: Partsman, Farm Machinery Partsman.

Job Description:

A Partsman in a farm machinery dealership is responsible for the selling of spare and replacement parts to customers and dispensing replacement parts for service jobs. A Partsman is responsible for receiving, storing, and maintaining an inventory of machinery parts. The partsman must be able to identify parts, determine parts numbers, and determine prices. Continual contact with customers through sales requires that a Partsman be able to work harmoniously with customers to maximize customer satisfaction.

Competencies Identified and Validated

N = 30*

Competencies		Weighted Mean**
1.	Learn parts sales techniques.	3.3
a.	Determine price of part from price lists.	3.8
b.	Sell parts to customers.	3.8
c.	Make out sales receipts.	3.8
d.	Use parts catalog or microfilm to determine part name and stock numbers.	3.8
e.	Read and interpret diagrams in parts manuals.	3.7
f.	Receive telephone orders for parts.	3.6
g.	Determine the make, model, year, and type of equipment for which a part is needed.	3.6
h.	Record parts identification and price on service tickets.	3.6
i.	Make out credit slips and re-stock returned parts.	3.5
j.	Locate and retrieve parts from storage area.	3.5
k.	Advise customers when out-of-stock parts will be available.	3.5
l.	Determine that any new parts returned for credit are complete and undamaged.	3.4
m.	Advise customers of parts needed.	3.4
n.	Advise customers of related parts, accessories, and consumable items that may be needed.	3.4
o.	Sell related parts, accessories, and consumable items to customers.	3.4

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* Responses from 30 Farm Machinery Dealers in 9 states. Survey conducted by Agricultural and Occupational Education Division of the Education Department, Cornell University, Ithaca, New York 14853.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

p.	Interpret serial numbers to identify model of equipment for which a part is needed.	3.3
q.	Refer customers to salesperson for major equipment purchases.	3.3
r.	Identify parts needed by service department from verbal description.	3.3
s.	Dispense parts to service department.	3.3
t.	Guide customers to location of serial and parts numbers on equipment.	3.2
u.	Explain parts warranty and guarantee provisions to customers.	3.2
v.	Encourage multiple purchases of consumable items.	3.1
w.	Explain dealer policy to customers.	3.1
x.	Use adding machine to total prices.	3.1
y.	Provide customer refunds or exchanges under manufacturer's warrantees or dealership guarantees.	3.0
z.	Check credit references of customers.	2.8
aa.	Operate cash register to record sales.	2.8
bb.	Refer customers to other dealers for parts not in current inventory or discontinued.	2.7
cc.	Refer customers to shop for evaluation of warranty coverage on parts returned.	2.6
dd.	Advise customers on procedure for installation of parts.	2.4
2.	Learn warehousing and merchandising systems.	2.8
a.	Store parts in stockroom according to dealership inventory system.	3.7
b.	Arrange stockroom for efficient use.	3.4
c.	Display new and fast moving items.	3.2
d.	Stock self-service shelves with consumable items.	3.0
e.	Prepare and maintain displays of tools and accessories.	2.6
f.	Put price tags on displayed items.	2.5
g.	Assemble small equipment such as chainsaws, mulchers, etc.	1.4
3.	Use processing and shipping skills.	3.3
a.	Unpack and check items received against invoices.	3.8
b.	Resolve any shortages, damaged, or wrong items in shipments received.	3.8
c.	Make out invoices for items to be shipped.	3.5
d.	Mail or ship parts to fill customer orders.	3.4
e.	Ship warranty claim parts to manufacturer for credit.	3.3
f.	Package parts for shipping.	3.3

g.	Ship defective parts to manufacturer for credit.	3.3
h.	Ship parts via least cost carrier.	3.1
i.	Ship exchange parts to manufacturer for rebuilding.	3.0
j.	Arrange for insurance on shipments according to dealership policies.	2.9
k.	Compute postage and freight for parts shipment.	2.8
4.	Control inventory.	2.9
a.	Use rush orders for breakdown parts.	3.8
b.	Order out-of-stock parts for customers and repair jobs in shop.	3.7
c.	Maintain current inventory of parts on control cards or computer printout.	3.5
d.	Identify fast moving parts for inventory increases.	3.5
e.	Order parts based on actual and anticipated sales.	3.3
f.	Order parts to take advantage of volume discounts.	3.2
g.	Identify new parts in excess of inventory.	3.1
h.	Conduct annual parts inventory for tax purposes.	3.1
i.	Maintain current tool and hardware inventory.	2.8
j.	Survey wholesalers for best prices and service.	2.8
k.	Dispose of obsolete parts.	2.8
l.	Use computer to locate parts in other dealerships.	2.5
m.	Calculate and analyze inventory turnover.	2.5
n.	Make out computer cards for parts orders.	2.3
o.	Purchase tools and hardware from salesperson.	1.7
p.	Cooperate in volume buying with other dealers.	1.5
5.	Keep records.	2.4
a.	Maintain complete and current parts catalogs and price lists.	3.7
b.	Adjust parts catalogs to reflect manufacturer's service bulletins.	3.4
c.	File sales slips as a record of sales.	2.4
d.	Prepare periodical sales reports for management.	2.0
e.	Maintain customer credit records.	2.0
f.	Maintain customer files relating to sales.	1.7
g.	Process tax exemption data for individual customers.	1.7
6.	Maintain an attractive parts department.	3.3
a.	Keep parts department clean, neat, and attractive.	3.6
b.	Maintain equipment and furniture.	3.0

7.	Practice good management.	2.9
a.	Predict seasonal needs for parts and consumable items.	3.2
b.	Advise management on inventory level for parts and consumable items.	3.1
c.	Designate excess and obsolete parts.	3.0
d.	Advise management in determining parts storage space requirements.	2.9
e.	Set prices for items not on manufacturer's price lists.	2.8
f.	Advise management on dealership policy for the parts department.	2.5
g.	Determine price discounts for wholesale and volume sales.	2.5
8.	Develop good work habits and attitudes.	3.6
a.	Honesty and personal integrity.	3.9
b.	Follow dealership policies and procedures.	3.8
c.	Follow directions.	3.8
d.	Courtesy in dealing with customers.	3.8
e.	Initiative for job.	3.7
f.	Dependability and thoroughness in job preferences.	3.7
g.	Accept and carry out responsibility.	3.7
h.	Willingness to learn.	3.7
i.	Harmonious working relationship with co-workers.	3.7
j.	Clean, neat, and well-groomed appearance.	3.6
k.	Positive attitude toward job.	3.6
l.	Enthusiasm for job.	3.6
m.	Perform work assignments to the best of ability.	3.6
n.	Punctuality on job.	3.6
o.	Cooperativeness on the job.	3.6
p.	Regular attendance.	3.6
q.	Loyalty to employer.	3.6
r.	Accept and profit from constructive criticism.	3.5
s.	Follow dealership safety procedures and policies.	3.5
t.	Flexibility to change.	3.4
u.	Willingness to work overtime when needed.	3.4
v.	Alert customers and others to hazardous situations.	3.4
w.	Observe situations or conditions creating hazards.	3.4
x.	Advise management about existing safety hazards, and work to correct them.	3.4
y.	Careful use of tools.	3.1

SMALL ENGINE MECHANIC

Other Titles: Lawn Mower Mechanic, Garden Tractor Mechanic, Mechanic

Job Description:

Persons in this occupation are involved in the care and repair of small gasoline engines. They assemble, disassemble, trouble-shoot and repair small engines up to 20 hp. They are responsible for their tools and keeping job time and parts for the repairs completed. They are also responsible for demonstrating the repaired engines to customers.

Competencies Identified and Validated

N = 31*

Competencies	Weighted Mean**
1. Have proficient use of written and oral communication.	3.3
a. Can communicate with customers.	3.6
b. Have high school degree or passed equivalent examination.	2.9
c. Neat appearance. #	
d. Can receive communication from supervisor. #	
e. Complete warranty claims forms. #	
2. Use and maintain parts and service manuals.	3.6
a. Follow written repair instructions.	3.7
b. Locate the proper manuals and specifications for specific equipment.	3.6
c. Read and interpret sketches and diagrams.	3.6
d. Use common sense. #	
e. Use microfiche machine. #	
3. Can use basic office procedures.	2.6
a. Use the telephone.	2.9
b. Be familiar with office forms.	2.6
c. Maintain file of office forms.	2.1
4. Use and maintain hand and power tools.	3.2
a. Select the proper hand tools.	3.7
b. Store and maintain tools.	3.5
c. Adjust tools.	3.5

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* Responses from 31 Small Engine Repair Shops in 21 states. Survey conducted by Agricultural Engineering Department, University of Maryland, College Park, Maryland 20740.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

Not included on questionnaire but recommended by some experts surveyed.

IRRIGATION TECHNICIAN

Other Titles: Ditch Tender, Irrigator-Sprinkler System, Irrigator-Stand Pipe, Irrigator - Valve Pipe, Ditch Rider.

Job Description:

Inspects area irrigated to insure adequate soaking and prevent waste of water. Opens head gate to permit entry of water into main ditches. Directs workers in cleaning and repairing ditches. Lays out and connects pipe along designated pipeline settings in the field. Operates revolving sprinklers in the field. Operates pumping system to irrigate crops. Observes revolving sprinklers to insure uniform distribution of water to all areas. Attaches vertical pipes to underground pipeline system to irrigate crops. Observes rate of flow and adjusts valves accordingly. Shovels soil into holes and low spots in levees and removes obstructions. Digs opening in embankment at end of row to direct overflow of water into spillway. Builds levees to prevent water from overflowing other crops or highways. Lubricates pumping equipment and makes minor repairs. Records daily weather data. Accurately takes soil moisture tests, and has a knowledge of crops and their moisture requirements.

Competencies Identified and Validated

N = 62*

Competencies		Weighted Mean**
1.	Operate sprinkler system.	3.3
	a. Operate sprinkler system for a specified time.	3.6
	b. Adjust continuously operating irrigation system to correct pressure for every location.	3.3
	c. Turn valves.	3.2
	d. Check gauges.	3.2
	e. Change valves.	3.2
2.	Perform maintenance activities.	3.2
	a. Replace broken pipe.	3.4
	b. Clean sprinklers.	3.3
	c. Repair broken valves.	3.3
	d. Dig up and repair underground valves.	3.3

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* Responses from 62 Irrigation Technicians in 30 states. Survey conducted by Department of Agricultural Education, California Polytechnic State University, San Luis Obispo, California 93401.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

	e.	Repair stabilizers.	3.2
	f.	Disassemble sprinkler systems.	3.1
3.		Lay out sprinkler systems.	3.1
	a.	Assemble and maintain piping systems and fixtures.	3.2
	b.	Install sprinkler heads.	3.2
	c.	Inspect line for leaks.	3.0
	d.	Design and install irrigation equipment in new areas.	2.9
4.		Distribute water into irrigation system.	2.9
	a.	Regulate irrigation system to convey water to farms in assigned area.	3.5
	b.	Contact water users to determine quantity of water needed, and time and duration of delivery.	2.9
	c.	Operate gates, checks and turnouts to regulate waterflow into canals and laterals.	2.8
	d.	Calculate and record quantities of water delivered for use in computing charges to farmers.	2.6
5.		Patrol and inspect irrigation system.	2.8
	a.	Supervise crew workers cleaning ditches, raising ditch banks, repairing concrete and wooden structures, and erecting fences and gates.	3.1
	b.	Fill holes and exterminate rodents.	3.0
	c.	Patrol assigned area by foot, horseback, or motor vehicle to detect leaks, breaks, weak areas, obstructions, and damage to irrigation systems.	2.9
	d.	Remove debris and make emergency repairs to banks, structures, gates, and canal roads.	2.9
	e.	Prepare reports on condition of system and equipment, and replacements or repairs needed.	2.5
	f.	Patrol canal at night to determine that water is flowing in prescribed volume into users ditches.	2.2
6.		Provide data for irrigation system.	2.6
	a.	Recognize specific growth stage of crops. and their irrigation requirements.	3.0
	b.	Check soil moisture conditions.	3.0
	c.	Record and plot daily weather data and keep in adjustment all instruments at the climatic stations.	2.6

	d.	Obtain information on wind and rainfall conditions.	2.4
	e.	Change weekly weather charts.	2.2
7.		Operate irrigation pumps.	2.4
	a.	Perform maintenance activities in the pumping plant.	2.7
	b.	Select correct motor for type of pump.	2.2
	c.	Repair and adjust motors.	2.2

PLANT MAINTENANCE MECHANIC

(Fruit and Vegetable Processing Industry)

Other Titles: General Mechanic, Maintenance Journeyman, Department Mechanic, Plant Engineer.

Job Description:

Installs, assembles, maintains, and overhauls plant machinery and equipment. Reads sketches, prints, and operating instructions and determines procedures. Checks materials and parts and makes requisitions. Tests, times and adjusts machinery and equipment. Operates various hand tools and equipment including welding equipment. May direct mechanical and maintenance crews.

Competencies Identified and Validated

N = 29*

Competencies		Weighted Means**
1.	Attitudes and personal traits.	
a.	Be safety conscious and practice safe mechanical procedures.	3.8
b.	Must be mechanically inclined.	3.7
c.	Must be careful and conscientious.	3.7
d.	Be able to communicate with co-workers.	3.6
e.	Must be physically capable of performing light to hard manual labor.	3.5
f.	Be able to correctly diagnose mechanical failures or troubleshoot.	3.4
g.	Be able to work in high tension and stressful situations.	3.3
h.	Be able to organize and direct helpers.	3.0
2.	Skills and abilities.	
a.	Change bearings.	3.6
b.	Change sprockets.	3.6
c.	Tighten belts.	3.6
d.	Perform emergency repairs.	3.6
e.	Be able to operate a drill press.	3.6
f.	Be able to operate a cutting torch.	3.5
g.	Install pulleys.	3.5
h.	Lace belts.	3.5
i.	Repair link chains.	3.5

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* Responses from 29 Fruit and Vegetable Processing Plant Maintenance Mechanics throughout the United States. Survey conducted by the Agricultural Education Unit, Department of Applied Behavioral Sciences, University of California, Davis, California 95616.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

j.	Install safety guards and braces.	3.5
k.	Tear down and reassemble machirery and equipment.	3.5
l.	Be able to operate an electric arc welder.	3.4
m.	Be able to operate an oxy-acetylene welder.	3.4
n.	Be able to operate a brazing torch.	3.4
o.	Fabricate materials for mounts.	3.4
p.	Pack bearings.	3.4
q.	Test and time machinery.	3.4
r.	Be able to operate a stainless steel welder.	3.1
s.	Be able to operate a micrometer.	3.0
t.	Read gauges on micrometers and other precision tools.	3.0
u.	Maintain and repair hydraulic systems.	3.0
v.	Maintain and repair phneumatic systems.	3.0
w.	Be able to operate a heliarch welder.	2.9
x.	Maintain and repair centrifugal and positive displacement pumps.	2.9
y.	Can do sheet metal work.	2.7
z.	Be able to operate a surface grinder.	2.6
aa.	Be responsible for plumbing, maintenance and repair.	2.5
bb.	Keep accurate records.	2.2
cc.	Make parts requisitions.	2.2
dd.	Be able to operate a jack hammer.	2.0
ee.	Keep accurate time cards.	2.0
ff.	Be able to operate a milling machine.	1.9
gg.	Be responsible for painting procedures.	1.8
hh.	Perform necessary carpentry functions.	1.8
ii.	Keep accurate inventories.	1.8
jj.	Perform electrical maintenance and repair procedures.	1.7
kk.	Perform concrete work.	1.7
ll.	Be able to operate a shaper.	1.6
mm.	Be able to operate a turret lathe.	1.5
nn.	Make automotive repairs.	1.5
oo.	Keep accurate cost sheets.	1.2

3. Concepts and Facts.

a.	Be able to read and write English.	3.6
b.	Have knowledge of OSHA standards.	3.1
c.	Have basic understanding of mathematics.	3.1
d.	Know where to obtain current OSHA standards.	2.9
e.	Have knowledge of current FDA standards.	2.7
f.	Understand operating principles of centrifugal and positive displacement pumps.	2.7
g.	Have a basic understanding of the principles of engine operation.	2.4
h.	Have knowledge of metal stresses and fatigues.	2.3
i.	Have an understanding of temperatures and indicators of temperature (i.e., color of heating metal, thermometers).	2.2
j.	Have a basic understanding of electrolysis.	1.7

FISH CANNERY WORKER

Job Description:

The Fish Cannery Worker works in a fish cannery, whether large or small, and is involved in the cleaning, cooking, boning, and canning of fish. He or she may be employed in a small cannery doing several jobs or in a large cannery doing one or only a few jobs.

Competencies Identified and Validated

N = 31*

Competencies	Weighted Mean**
1. Perform fish room skills and competencies.	2.4
a. Gut fish.	3.3
b. Examine raw fish (smeller).	3.2
c. Cut tuna.	2.9
d. Remove bones.	2.9
e. Remove skin.	2.9
f. Operate shaping and cutting machine.	2.5
g. Separate dark meat.	2.4
h. Remove loins (white meat).	2.4
i. Operate labeling machine.	2.4
j. Cut sardines.	2.3
k. Cut mackerel.	2.3
l. Rack fish.	2.3
m. Operate sealing machine.	2.3
n. Unload cooker.	2.2
o. Load cooler room.	2.2
p. Load cooker.	2.1
q. Load cooler.	2.1
r. Operate canning machine.	2.0
s. Load cleaning tables.	1.6
2. Perform miscellaneous jobs.	2.1
a. Scale operator.	2.6
b. Inspect for quality control.	2.1
c. Maintain machinery (mechanic).	2.1
d. Operate jitney (forklift).	1.9
e. Operate dock hoist.	1.9
3. Observe safety precautions.	2.9
a. Follow safe work habits.	3.1

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* Responses from 31 Fish Canneries and Retail Fish Markets in 12 states. Survey conducted by the Agricultural Education Department, California Polytechnic State University, San Luis Obispo, California 93407.

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b.	Wear appropriate protective clothing.	3.0
c.	Use proper lifting and carrying methods.	3.0
d.	Wear appropriate work clothing.	3.0
e.	Identify potential safety hazards.	2.8
f.	Correct potential safety hazards.	2.8
g.	Remove debris from work areas.	2.8
h.	Apply first aid to minor cuts, bruises and burns.	2.6
4.	Sanitize fish canning facilities.	2.9
a.	Identify personal sanitation practices to follow.	3.1
b.	Clean and sanitize floors and walls in cleaning room.	3.0
c.	Clean and sanitize fish cutting tools.	3.0
d.	Clean and sanitize floor and walls in butchering room.	2.9
e.	Clean and sanitize racks and counters.	2.9
f.	Identify sanitation requirements for licensing.	2.9
g.	Select appropriate cleaning and sanitizing agents and equipment.	2.6
h.	Evaluate influence sanitary conditions may have on fish spoilage.	2.5

RETAIL FISH CUTTER

Job Description:

The Retail Fish Cutter works in a retail store or in the meat department of a retail store. The Retail Fish Cutter works with records kept in the fish department, cutting fish, and displaying cuts of fish for sale. In general, the Retail Fish Cutter helps maintain inventories of fish on hand, maintains sanitary working areas; cuts fish; packages and displays fish, and assists in the purchasing and managing of the retail fish store.

Competencies Identified and Validated

N = 31*

Competencies	Weighted Mean**
1. Perform general office procedures.	2.3
a. Meet people.	3.0
b. Use telephone.	2.3
c. Write memos, letters, and notes.	2.1
d. File various items of information.	1.8
2. Record information.	2.5
a. Record customer order information.	3.1
b. Record inventory information on sheets.	2.4
c. Record amount of fish processed during day.	2.0
3. Inventory fish.	2.9
a. Remove damaged fish from inventory.	3.3
b. Take a physical inventory.	3.2
c. Determine amount of fish inventory on hand from records.	2.2
4. Follow legal regulations.	2.5
a. Display appropriate inspection certificates.	2.7
b. Interpret local, state, and federal inspection requirements.	2.3
5. Observe safety precautions.	2.8
a. Remove debris from work areas.	3.2
b. Follow safe work habits.	3.0
c. Correct potential safety hazards.	2.9
d. Apply first aid to minor cuts.	2.6
e. Identify potential safety hazards.	2.6
f. Wear'appropriate work clothing.	2.6

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** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

6.	Sell and display fish.	3.1
a.	Greet customers.	3.6
b.	Interpret customer's orders for various cuts.	3.6
c.	Price various fish for customers.	3.6
d.	Operate cash register.	3.6
e.	Weigh fish for customers.	3.6
f.	Describe various fish items to customers.	3.5
g.	Arrange fish displays.	3.4
h.	Receive customer orders by telephone.	3.3
i.	Put fish in counter.	3.2
j.	Stock fish displays.	3.2
k.	Label fish in display cases.	3.2
l.	Put ice in counter.	2.8
m.	Handle customer complaints.	2.7
n.	Prepare advertisement.	1.8
o.	Determine percent markup and profits.	1.6
7.	Receive fish shipments.	3.1
a.	Check material received against order.	3.5
b.	Inspect merchandise for damage.	3.5
c.	Record discrepancies on invoices.	3.4
d.	Sign shipping receipt.	3.1
e.	Help unload shipments.	2.9
8.	Use and maintain hand and power fish cutting tools and equipment.	2.5
a.	Use knives.	3.5
b.	Clean tools.	3.3
c.	Use power saw and equipment safely.	3.2
d.	Identify tools.	2.9
e.	Use saw.	2.9
f.	Use hand tools safely.	2.8
g.	Select appropriate tools and equipment for specific jobs.	2.5
h.	Sharpen tools.	2.5
i.	Use cutting board.	2.5
j.	Store tools.	2.3
k.	Use scaler.	2.3
l.	Adjust tools and equipment.	2.2
m.	Use plyers.	1.9
n.	Use dikes.	1.8
o.	Recondition tools.	1.0
9.	Package fish.	2.7
a.	Weigh fish for packaging.	3.5
b.	Select appropriate wrapping materials.	2.5
c.	Label packages for customers.	2.2
10.	Purchase fish and supplies.	2.2
a.	Determine what to order.	2.3
b.	Determine when to order.	2.3

c.	Determine the quantity of fish to keep on hand.	2.3
d.	Determine the amount to order.	2.2
e.	Compare and verify costs of fish from various suppliers.	1.9
f.	Identify various sources of fish suppliers.	1.9
11.	Cut fish.	3.1
a.	Steak fish.	3.4
b.	Fillet fish.	3.4
c.	Split fish in two.	3.3
d.	Cut off fins.	3.2
e.	Gut fish.	3.2
f.	Cut off head.	3.1
g.	Scale fish.	2.7
h.	Skin fish (cat fish).	2.6
12.	Refrigerate and store fish.	3.1
a.	Recognize signs of fish spoilage.	3.8
b.	Read thermometers in storage areas.	3.3
c.	Control temperature in storage areas.	3.0
d.	Determine freezer storage life of various fish.	2.8
e.	Determine temperature for fish storage areas.	2.7
f.	Evaluate influence temperature, humidity, and air circulation have on longevity of fish.	2.7
13.	Sanitize fish cutting facilities.	3.1
a.	Clean and sanitize fish cutting tools.	3.3
b.	Clean and sanitize display cases.	3.2
c.	Clean and sanitize floors, ceilings, and walls in the cutting room and cooler.	3.1
d.	Identify personal sanitation practices to follow.	3.1
e.	Clean and sanitize power fish cutting tools.	3.0
f.	Clean and sanitize racks and counters in the cutting room and cooler.	3.0
g.	Select appropriate cleaning and sanitizing agents and equipment.	2.9

RENEWABLE NATURAL RESOURCES

Occupations in this instructional area touch the lives of millions of persons living in the United States. Nearly everyone is interested in our renewable natural resources and well they should be. Clean air, pure water, and productive soil are basic to our health and productivity. Occupations surveyed in this National Study can be found on the pages listed below.

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AIR POLLUTION CONTROL INSPECTOR

Job Description:

The Air Pollution Control Inspector is responsible for field surveillance of air pollution. Documents the sources, quantity, and density of the air pollution. Investigates complaints by observing pollution conditions, interviews complaintants, owners, and operators of allegedly polluting equipment and facilities. Compiles detailed reports on complaint investigations together with recommendations as to corrective actions. Provides assistance to, may make work assignments to, and lead other employees. Assists professional staff in conducting special studies, assists in training lower level employees. Maintains an effective relationship with representatives of public and private agencies and organizations. Maintains and improves personal level of technical competency through reading and training. Usually works for a governmental agency.

Competencies Identified and Validated

N = 31*

Competencies			Weighted Mean**
1.	Inspect equipment semi-annually or annually.		3.3
	a.	Inspect effectiveness of control devices.	3.4
	b.	Locate quantity, density, and source of emission.	3.4
	c.	Collect information about the equipment.	3.3
	d.	Interact with personnel who operate the equipment.	3.1
	e.	Make recommendations to company management when requested.	3.1
2.	Prepare and serve notices of violations.		3.5
	a.	Identify the violator's name, address, etc.	3.8
	b.	Describe and note conditions of violation.	3.8
	c.	Record remarks made by operator.	3.3
	d.	Recommend remedial action.	3.1
3.	Perform on-site inspections.		3.8
	a.	Observe smoke stacks.	3.8
	b.	Observe incinerators.	3.8
4.	Contact authority.		3.5
	a.	Inform them of inspection.	3.6

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* Responses from 31 Air Pollution Control Inspectors and their work supervisors in 11 states. Survey conducted by Department of Agricultural Education, The Pennsylvania State University, University Park, Pennsylvania 16802.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

	b.	Request needed assistance.	3.5
	c.	Review inspections with supervisors.	3.2
5.		Assist training lower-level employees.	3.0
	a.	Enforce employee safety regulations.	3.5
	b.	Demonstrate understanding of tasks performed.	3.2
6.		Conduct complaint investigations.	2.7
	a.	Visit complaintant to identify complaint, emission, source, time, and frequency.	3.8
	b.	Observe alleged source.	3.6
	c.	Arrange for an inspection.	3.4
	d.	Report steps taken.	3.3
	e.	Solicit local support.	2.8
	f.	Contact complaintant by phone.	2.7
7.		File reports.	3.7
	a.	Describe results of inspection.	3.7
	b.	Report suspected violations.	3.7
	c.	Follow-up inspections.	3.5
8.		Serve as a witness.	3.2
	a.	Present testimony.	3.3
	b.	Refer to file on history of case.	3.0
9.		Keep accurate records.	3.7
	a.	Record observation and data of inspection findings.	3.9
	b.	Compile reports on complaint investigations.	3.8
	c.	Record surveillance data.	3.5
	d.	Maintain daily records of activities.	3.4
10.		Perform public relations work.	2.9
	a.	Maintain an effective relationship with public and private agencies.	2.9
	b.	Act as a resource person.	2.1
	c.	Prepare information reports for public.	1.6
	d.	Write news releases.	1.3

AIR POLLUTION CONTROL TECHNICIAN

Other Titles: Environmental Inspector, Environmental Technician, Environmental Quality Engineer.

Job Description:

The Air Pollution Control Technician is responsible for installing, operating, modifying, maintaining, and repairing air sampling equipment. Conducts stack sampling activities and gathers data for source and emission; performs routine tests and measurements including standardized analyses of air pollutants. Fabricates field shelters and facilities, assists in the placement of air sampling and meteorological instruments and equipment. Operates and is responsible for the daily maintenance on vehicles used for field work; records, tabulates, charts, and graphs data obtained from air sampling equipment, meteorological instruments, and laboratory analysis; assists higher-level staff conducting the more complex tests, measurements, and analysis. Assists designing or modifying instruments and equipment, plus receiving and evaluating engineering proposals for new and modified industrial processes. Provides technical assistance, may make work assignments, and guides lower level employees; may attend air pollution control hearings to present data and is liable for a witness in a court issue. Assists in training lower level employees; maintains and improves technical competence through reading and training, works independently on specialized assignments; performs related duties as assigned.

Competencies Identified and Validated

N = 37*

Competencies	Weighted Mean**
1. Install air sampling equipment.	3.4
a. Use safety standards in installation of equipment.	3.4
b. Install in accordance with federal and state regulations.	3.4
c. Utilize installation manual for each type of air sampling equipment.	3.3

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* Responses from 37 Air Pollution Control Technicians and their work supervisors in 12 states. Survey conducted by Department of Agricultural Education, The Pennsylvania State University, University Park, Pennsylvania 16802.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

2.	Operate air sampling equipment.	3.3
a.	Operate in accordance with federal and state regulations.	3.6
b.	Utilize the operator's manual.	3.5
c.	Maintain equipment according to operator's manual.	3.5
d.	Adjust equipment for maximum efficiency.	3.2
e.	Perform major maintenance of equipment.	2.7
3.	Conduct routine tests and measurements using standardized procedures.	2.4
a.	Record analyses of air pollutants.	3.0
b.	Tabulate, chart, and graph data.	2.9
c.	Perform ambient air monitoring.	2.9
d.	Test for amount of emission.	2.8
e.	Record data on type of emission.	2.7
f.	Measure for sources of pollutants.	2.5
g.	Record data from meteorological instruments.	2.5
h.	Perform stack gas sampling.	2.0
i.	Perform exhaust emission tests from moving sources.	1.5
j.	Conduct industrial hygiene surveys.	0.7
4.	Assist in reviewing and evaluating proposals for equipment changes.	1.7
a.	Review and evaluate existing process and associated equipment.	1.7
b.	Make recommendations in accordance with state and federal regulations.	1.7
c.	Assist in the review of engineering proposals and drawings for new or modified industrial processes and facilities.	1.6
5.	Supervise non-professional and temporary field personnel.	2.1
a.	Interpret directions and plans.	2.2
b.	Demonstrate a general understanding of the tasks performed by all employees under his supervision.	2.2
c.	Enforce employee safety regulations and standards.	2.1
d.	Train new personnel.	2.1
e.	Plan and supervise work schedules.	1.8
6.	Attend air pollution control hearings and professional meetings.	1.9
a.	Testify as a witness in court cases.	2.0
b.	Present evidence and data.	1.9
7.	Perform public relations work.	1.1
a.	Explain general program and specific objectives to individuals and groups.	1.7

	b.	Conduct educational tours.	1.5
	c.	Act as a resource person in program area. .	1.2
	d.	Prepare informative reports and other literature for public use.	1.0
	e.	Participate in radio and television programs.	0.8
	f.	Write news releases.	0.6
8.	Operate equipment and machinery.		3.0
	a.	Recognize malfunctions in equipment.	3.4
	b.	Adjust equipment under field conditions for maximum efficiency.	3.3
	c.	Become familiar with operator's manual for each piece of equipment.	3.3
	d.	Use safety standards relating to the operation of a particular piece of machinery.	3.2
	e.	Maintain records of maintenance and repair of machinery and equipment.	3.2
	f.	Service machinery and equipment according to operator's manual.	3.1
	g.	Operate machinery and equipment under a variety of field conditions.	3.1
	h.	Attach accessory equipment to basic power unit.	2.8
	i.	Hold a valid operator's license where necessary.	2.8
	j.	Maintain a daily log of number of hours each piece of equipment is used.	2.7
	k.	Prepare machines and equipment for storage.	2.5

FISH CONSERVATION OFFICER

Other Titles: Waterways Patrolman, Fish Warden.

Job Description:

Patrols assigned areas to prevent fish law violations; issues warnings and citations; services warrants, makes arrests and prepares and presents evidence in court; seizes equipment used in fish law violations and arranges for disposition of fish illegally taken or possessed; obtains samples of fish from creels of fishermen for studies by fisheries biologists; works irregular hours under varied climatic conditions; maintains public relations with sportsmen's organizations; investigates pollution reports; works with groups for stream improvement.

Competencies Identified and Validated

N = 37*

Competencies	Weighted Mean**
1. Enforce law on boating and fishing.	3.5
a. Know federal and state laws on fishing and boating.	3.6
b. Check licenses for fishing and boating.	3.5
c. Use firmness and tact.	3.5
d. Investigate and arrest violators.	3.5
e. Prevent fish law violations.	3.4
f. Issue warnings and citations.	3.3
2. Prepare cases for prosecution.	3.3
a. Obtain evidence for legal action.	3.7
b. Testify in legal action.	3.6
c. Obtain and serve warrants.	3.1
d. Consult a legal opinion.	2.9
3. Prepare and keep records in cooperation with fishery biologists.	1.4
a. Keep record of fish taken in area.	1.5
b. Evaluate fish habitat.	1.5
c. Inventory species of fish in area.	1.3
d. Determine available feed for fish.	1.3
4. Maintain fish population in area.	1.5
a. Recommend stocking procedure.	1.5

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* Responses from 37 Fish Conservation Officers and their work supervisors in 22 states. Survey conducted by Department of Agricultural Education, The Pennsylvania State University, University Park, Pennsylvania 16802.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

	b.	Recommend fishing season.	1.4
	c.	Recommend fish refuges.	1.4
5.	Dispose of fish killed accidentally or illegally.		2.1
	a.	Prepare report on incident.	2.4
	b.	Dispose of dead fish properly.	1.9
6.	Explain fishing and boating laws to public.		3.4
	a.	Keep aware of new law changes.	3.6
	b.	Explain and interpret provisions of the law.	3.5
	c.	Give talks to groups upon request.	3.1
7.	Provide public relations.		2.4
	a.	Address audience interested in fishing.	2.8
	b.	Assist sportsmen's clubs in fishing interest.	2.7
	c.	Distribute brochures, pamphlets.	2.5
	d.	Participate in radio and TV programs.	2.3
	e.	Write newspaper articles for publication.	1.7
8.	Supervise public in stream improvement project.		1.5
	a.	Aid biologists in planning.	1.8
	b.	Provide publicity.	1.6
	c.	Organize work and program.	1.5
	d.	Provide fish.	1.0
9.	Investigate pollution reports.		2.6
	a.	Report polluters.	3.3
	b.	Take water samples to be analyzed.	2.8
	c.	Monitor potential pollutors.	2.3
	d.	Advise public on pollution problems.	2.2
10.	Operate boats and equipment.		3.3
	a.	Patrol restricted areas.	3.6
	b.	Handle safely all types of small craft under variety of field conditions.	3.6
	c.	Travel to observe persons fishing or boating.	3.5
	d.	Keep boat in working order.	3.5
	e.	Recognize malfunctions in equipment.	3.3
	f.	Adjust equipment under field conditions.	3.2
	g.	Hold a valid operator's license when necessary.	2.9
	h.	Know how to service outboard motors and adjust them for maximum efficiency.	2.8
11.	Maintain a district office.		3.0
	a.	Communicate with supervisor and clientele.	3.5
	b.	Keep complete files on all reports.	3.0
	c.	Maintain records on all surveys.	2.6

FISH HATCHERY WORKER

Other Titles: Fish Hatchery Superintendent, Hatchery Man, Fish Hatchery Assistant, Fish Culturist, Fish Hatchery Manager, Hatchery Aide, Fish Technician.

Job Description:

Installs and maintains racks and traps; spawns fish; packs, transfers and incubates eggs; hatches fish; prepares food and feeds fish; cleans troughs, ponds and equipment; places fish in ponds; repairs and improves ponds, equipment and hatchery grounds; tests for oxygen deficiency and pH level in ponds; measures water temperature; handles live fish; helps keep records and prepares reports; collects data on fish habitat conditions and helps analyze reports; operates related fish hatchery equipment.

Competencies Identified and Validated

N = 40*

Competencies	Weighted Mean**
1. Identify species of gamefish, panfish, baitfish, and trashfish.	2.7
a. Understand feeding habits.	2.9
b. Recognize shapes and sizes.	2.8
c. Know coloration.	2.6
d. Recognize fish habitat.	2.6
2. Identify and properly use tools for work.	3.5
a. Practice safety while using tools.	3.6
b. Keep tools in good working order.	3.5
c. Know how to use fish nets.	3.4
3. Operate and maintain hatchery equipment.	3.0
a. Understand operation of equipment.	3.6
b. Practice safety when using equipment.	3.6
c. Use pumps and aerators.	3.4
d. Clean service tanks.	3.1
e. Operate mechanical fish sorting device.	2.8
f. Handle boats.	2.7
g. Build racks and traps.	2.7
h. Adjust racks and traps.	2.7
4. Help maintain buildings and grounds.	2.4

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* Responses from 40 Fish Hatchery Workers and their work supervisors in 27 states. Survey conducted by Department of Agricultural Education, The Pennsylvania State University, University Park, Pennsylvania 16802.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

a.	Assist in carpentry work.	2.6
b.	Paint buildings.	2.5
c.	Mow, fertilize, and irrigate grass.	2.5
d.	Pour and repair concrete.	2.3
e.	Care for trees and shrubs.	2.3
5.	Perform mathematical computations.	3.1
a.	Count and record number of fish.	3.5
b.	Read thermometers and record readings.	3.5
c.	Count and record number of fish spawned.	3.3
d.	Determine feed ratios.	3.0
e.	Prepare statistical reports.	2.3
6.	Record activities.	2.9
a.	List mortality rate.	3.3
b.	Keep a work diary.	3.1
c.	Prepare order forms.	2.3
7.	Prepare hatchery tanks for spawning.	3.2
a.	Clean and repair tanks.	3.4
b.	Fill tanks.	3.2
c.	Determine stocking rate for tank.	2.8
8.	Spawn fish.	3.1
a.	Collect sperm and then fertilize eggs.	3.3
b.	Sort various species of fish.	3.2
c.	Understand life cycle of fish.	3.1
d.	Know breeding habits.	3.1
e.	Calculate time and frequency of fertilization.	2.7
9.	Recognize diseased and unfertilized eggs.	3.2
a.	Report findings.	3.6
b.	Treat diseases as directed.	3.6
c.	Determine proper amount of feed.	3.3
d.	Prepare food.	2.8
e.	Determine proper aquatic rations.	2.2
10.	Feed fish.	3.0
a.	Know different types and forms of feed.	3.4
b.	Dispense food.	3.4
c.	Determine proper amount of feed.	3.3
d.	Prepare food.	2.8
e.	Determine proper aquatic ration.	2.2
11.	Check oxygen level, pH, temperature, and hardness of water.	3.0
a.	Report findings.	3.1
b.	Use special measuring equipment.	3.0
c.	Compile data.	2.9
d.	Use chemicals as directed to offset certain deficiencies.	2.8

12.	Determine stocking rate for ponds.	2.0
a.	Calculate surface and running water.	2.3
b.	Estimate stocking rate.	2.0
c.	Establish time for stocking.	2.0
d.	Measure food resources.	1.8
13.	Handle fish.	3.3
a.	Transfer fish without harming.	3.7
b.	Stock ponds and streams.	3.3
c.	Use nets to collect fish.	3.2
d.	Know different ways of stocking fish.	3.0
14.	Control undesirable vegetation.	2.3
a.	Recognize algae blooms.	2.5
b.	Use chemicals or physical means to control aquatic weeds.	2.4
c.	Know common aquatic weeds.	2.3
d.	Understand biological control.	2.2
15.	Understand economics.	1.0
a.	Determine overhead expenses.	1.3
b.	Calculate potential income of private hatchery.	1.1
c.	Realize if there is a market for fish.	1.0
d.	Sell fish.	0.9
16.	Practice good management principles.	2.1
a.	Use proper hatching procedures.	3.1
b.	Understand fish laws of state.	2.9
c.	Keep records of expenses, tools, fish sold, etc.	1.9
d.	Recruit labor needed.	1.5
e.	Know when to sell fish.	1.0

FISH RESEARCH TECHNICIAN

Other Titles: Fisheries Management Specialist, Fish Conservation Technician, Fisheries Biologist, Fisheries Laboratory Technician.

Job Description:

Aid fish biologist in studies of fish nutrition, behavior, physiology, reproduction; captures fish for study; marks and transfers fish from one area to another; conducts biological studies of fish populations; records such data as size; fecundity of females and stomach contents; studies daily and seasonal movements and feeding habits of fish populations; collects and compiles fisheries resource data and prepares reports; works under varying climatic conditions; performs general maintenance of fish culture equipment and facilities.

Competencies Identified and Validated

N = 37*

Competencies		Weighted Mean**
1.	Aid fish biologist in performing research studies.	2.9
	a. Prepare physical set up for experiments.	3.1
	b. Collect samples for studies of suspected pollution.	3.1
	c. Assist in pick-up and delivery of supplies.	2.7
2.	Supervise non-professional and field personnel.	2.2
	a. Interpret directions and plans.	3.1
	b. Enforce employee safety regulations and standards.	2.4
	c. Plan and supervise work schedule.	2.2
	d. Organize hatchery and personnel functions.	1.3
3.	Recognize symptoms and know controls of common fish diseases and parasites.	2.1
	a. Identify diseased fish.	2.4
	b. Aid in treatment of diseased fish.	2.3
	c. Control parasites, pathogens and diseases as directed by supervisor.	2.2
	d. Identify fish parasites.	2.0
	e. Identify fish pathogens.	1.7
4.	Conduct stream and lake surveys.	2.9

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* Responses from 37 Fish Research Technicians and their work supervisors in 27 states. Survey conducted by Department of Agricultural Education, The Pennsylvania State University, University Park, Pennsylvania 16802.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

a.	Collect fish for study.	3.4
b.	Collect water samples for chemical analysis.	3.1
c.	Study fish populations.	2.8
d.	Estimate water volume of streams, lakes and ponds.	2.7
5.	Collect aquatic weed samples.	2.0
a.	Identify aquatic weeds.	2.3
b.	Remove selected samples of weeds.	2.0
c.	Know growth habits of weeds.	1.9
d.	Apply physical and chemical controls of weeds.	1.9
6.	Use laboratory equipment.	2.2
a.	Use concepts of chemistry, physics, and biology to help conduct tests.	2.8
b.	Use balances and microscopes.	2.8
c.	Clean laboratory areas and equipment.	2.7
d.	Operate auto-sampling equipment.	2.3
e.	Test and evaluate equipment.	2.2
f.	Prepare media for bacteriological tests.	2.0
g.	Prepare fish samples for tissue processing.	2.0
h.	Operate water distillation unit and autoclave.	1.9
i.	Take blood samples.	1.5
7.	Perform chemical and physical analysis of water.	2.3
a.	Check water for pH, hardness, and pollution.	3.2
b.	Check for algae growth.	2.7
c.	Determine excessive amounts of chemical elements.	2.7
d.	Set up water quality experiment equipment.	2.0
e.	Operate water quality equipment including:	
(1)	Hach chemistry kit.	2.6
(2)	Ozonator.	1.7
(3)	Weiss Saturometer.	1.6
8.	Install and calibrate rain gauges, pH meters, lysine and current meters.	2.8
a.	Operate equipment under a variety of field conditions.	2.9
b.	Adjust equipment under field conditions for maximum efficiency.	2.9
c.	Service equipment according to operator's manual.	2.8
d.	Recognize malfunctions in equipment.	2.8

9.	Compile fisheries resource data.	3.0
a.	Measure age and size of fish.	3.3
b.	Conduct census of fish populations.	3.2
c.	Prepare illustrations, tables, and graphs for reports on data.	2.9
d.	Determine fecundity of females.	2.8
e.	Study daily and seasonal movements of fish and their feeding habits.	2.7
10.	Maintain fish culture equipment and facilities.	1.8
a.	Maintain nets, graders, aerators, and related equipment.	2.7
b.	Service on-site equipment.	2.5
c.	Maintain experimental fish lots.	2.3
d.	Clean and repair ponds, screens, and tanks.	2.2
11.	Communicate with public.	2.1
a.	Conduct educational tours.	2.3
b.	Assemble handout literature.	2.0

FORESTRY TECHNICIAN

Other Titles: Forest Technician, Log Scaler, Field Service Technician, Associate Forester, Associate Procurement Forester.

Job Description:

The Forest Technician is a person competent to occupy a responsible position in the line of authority between the skilled forest workers and the professional forester. The Forest Technician differs from the semi-skilled forester (aide) in knowledge of forestry theory and methods and has a more limited or specialized background and in the use of technical skills in support of forestry activities than a forester. The majority of Forest Technicians are employed by state and federal governments. Others work for private industry and forest owners. Examples of the type of work forest technicians perform are: forest surveying that includes boundary problems, deed research, campground, and pond layout; road location and reconnaissance, elevation and drainage systems; timber cruising and volume estimating; forest inventory work; timber sale layout and marking; timber buying; log and pump scaling; timber stand improvement; nursery cultural work in forest nurseries; fire control and assisting in presuppression and suppression activities; forest insect and disease observation and control; and park and recreation management of private and public campground and parks.

Competencies Identified and Validated

N = 35*

Competencies		Weighted Mean**
1.	Survey timber land and other areas.	2.9
a.	Interpret and use aerial photographs, topographic, and planimetric maps.	3.6
b.	Establish boundary lines.	3.4
c.	Locate logging and access roads.	3.0
d.	Perform semi-accurate, long distance survey approximations.	2.7
e.	Establish elevations for roads and drainage systems.	2.7
f.	Locate areas for dams, impoundments, ponds, and recreational uses.	2.1

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* Responses from 35 Forestry Technicians and their work supervisors in 20 states. Survey conducted by Department of Agricultural Education, The Pennsylvania State University, University Park, Pennsylvania 16802.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

2.	Prepare maps.		3.3
	a.	Perform neat, accurate mapping work.	3.6
	b.	Interpret aerial photographs to determine areas and locations.	3.5
	c.	Use various, simple drafting instruments.	3.3
	d.	Calculate areas from survey data.	3.1
	e.	Use survey data to prepare maps.	3.0
3.	Cruise timber.		3.3
	a.	Measure tree heights and diameters.	3.7
	b.	Interpret aerial photographs to identify forest cover types, forest classes and areas.	3.4
	c.	Lay out sample plots or strips.	3.4
	d.	Calculate volume of stands.	3.4
	e.	Determine saleable volume in forest products.	3.4
	f.	Keep records.	3.4
	g.	Mark timber for sales or for partial cutting.	3.4
	h.	Locate logging roads and aid in their construction and maintenance.	3.2
	i.	Measure tree growth.	3.1
	j.	Prepare inventory reports and stand analysis data.	3.1
	k.	Recommend logging methods.	2.7
4.	Supervise timber sales.		3.0
	a.	Create and maintain safety attitudes and practices.	3.5
	b.	Compute gross and net volumes.	3.2
	c.	Scale forest products.	3.0
	d.	Check scales for possible errors.	2.9
	e.	Interpret and enforce timber sale contracts.	2.8
	f.	Grade forest products.	2.7
5.	Perform timber stand improvement work.		2.9
	a.	Create and maintain safety attitudes and practices.	3.3
	b.	Instruct and assist crews in work methods.	3.1
	c.	Keep records.	3.1
	d.	Demonstrate proper cultural methods.	2.9
	e.	Prepare work layout and schedule.	2.7
	f.	Procure and mix chemicals.	2.4
6.	Plant trees and collect seeds.		2.7
	a.	Assist in planning reforestation work.	3.0
	b.	Protect planting stock.	2.9
	c.	Follow planting plan.	2.9
	d.	Plan and perform erosion control and recreational construction landscape planting.	2.6

	e.	Prepare planting site.	2.5
	f.	Procure planting stock.	2.5
7.		Perform nursery cultural work.	2.2
	a.	Keep records.	2.4
	b.	Hire temporary personnel.	2.3
	c.	Supervise seedling production, lifting, packaging, and shipping.	2.3
	d.	Treat seeds.	2.2
	e.	Conduct seed tests.	2.1
	f.	Calculate and analyze data.	1.8
8.		Control forest insects and disease.	3.0
	a.	Recognize and report insect and disease damage.	3.4
	b.	Prepare maps of infested areas.	3.3
	c.	Assist in insect and disease control measures.	3.1
	d.	Record, calculate, and analyze data.	2.8
	e.	Conduct experiments.	2.3
9.		Prevent and control forest fires.	2.6
	a.	Locate and report fires.	3.2
	b.	Serve as fire crew leader.	3.1
	c.	Operate fire tools and equipment.	3.0
	d.	Submit fire reports.	2.9
	e.	Assist in determining causes of fires and best control methods.	2.8
	f.	Maintain fire control supplies and equipment.	2.7
	g.	Dispatch fire crews.	2.6
	h.	Educate communities in fire prevention.	2.5
	i.	Measure fire characteristics.	2.4
	j.	Record fire crew time and material inventories.	2.4
	k.	Test best methods and materials for fire prevention and control.	2.3
	l.	Recruit, train and supervise forest fire wardens and crews.	2.2
	m.	Display a basic knowledge of air craft capacity for fire fighting methods.	1.9
10.		Administer outdoor recreational facilities.	2.5
	a.	Enforce rules and regulations.	2.6
	b.	Assist in planning, construction, operation, and maintenance of trails, campsites, etc.	2.4
	c.	Conduct public relations program.	2.4
	d.	Perform fire watch and control.	2.4
11.		Perform watershed practices.	2.5
	a.	Control flood run-off to reduce soil damage.	2.6

b.	Maintain soil stability.	2.6
c.	Improve vegetative cover.	2.5
12.	Manage fish and wildlife food habitat.	1.9
a.	Assist in wildlife habitat improvement.	2.4
b.	Supervise work crews.	2.3
c.	Maintain daily crew records.	2.2
d.	Assist in taking wildlife census.	2.0
e.	Perform research studies and experiments.	1.9
f.	Supervise controlled hunting and fishing.	1.8
g.	Manage animal use of grazing lands.	1.7
h.	Reseed grazing lands.	1.7
i.	Stock, rear, and feed fish and game species.	1.6
j.	Keep hunting and fishing records.	1.5
k.	Patrol restricted areas.	1.4
13.	Perform public relations work.	2.3
a.	Explain forestry objectives to individuals and groups.	3.1
b.	Prepare informative reports.	2.8
c.	Prepare literature for public use.	1.9
d.	Obtain and interpret pertinent information from public records.	1.9
e.	Write news releases.	1.8
14.	Operate equipment and machinery.	2.6
a.	Hold a valid operator's license where necessary.	3.3
b.	Use safety standards relating to the operation of a particular piece of machinery.	3.1
c.	Recognize malfunctions in equipment.	2.9
d.	Adjust equipment under field conditions for maximum efficiency.	2.8
e.	Become familiar with operator's manual for each piece of equipment.	2.7
f.	Operate machinery and equipment under a variety of field conditions.	2.7
g.	Service machinery and equipment according to operator's manual.	2.5
h.	Maintain a daily log of number of hours each piece of equipment is used.	2.5
i.	Maintain records of maintenance and repair of machinery and equipment.	2.4
j.	Attach accessory equipment to basic power unit.	2.1
k.	Prepare machines and equipment for storage.	1.9

LAND USE PLANNING AIDE

Other Titles: Surveyor's Apprentice, Engineering Aide, Field Engineering Aide, Party Chief.

Job Description:

The Land Use Planning Aide, under the direction of the survey party chief, sets up and operates surveying equipment; acts as a rodman and chainman; takes field notes and makes field sketches; measures distances, angles and elevations between stadia points; collects data pertinent to field studies; conducts field investigations to assure development concurs with project uses; and submits reports on the findings.

Competencies Identified and Validated

N = 34*

Competencies		Weighted Mean**
1.	Set up surveying equipment.	2.8
a.	Adjust and center tripod over points using plumb bob.	3.0
b.	Level instrument parallel to datum plane using levelling bubble.	2.9
c.	Carry and set stakes.	2.8
d.	Hold level-rod or stadia-rod.	2.8
e.	Secure instrument to tripod.	2.8
f.	Shield and carry optical equipment.	2.7
2.	Determine area measurements.	2.9
a.	Measure distances between points with transit and rod, cloth or steel tape, or surveyor's chain.	3.2
b.	Use photo-scales.	3.0
c.	Locate ground positions relative to maps.	2.9
d.	Use compass, aerial photographs, and topographic maps to pin-point positions.	2.8
e.	Record information on aerial photographs or in notes.	2.8
f.	Select turning points in consideration of immediate terrain and of the necessity for balancing shots.	2.8

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* Responses from 34 Land Use Planning Aides in 16 states. Survey conducted by Department of Agricultural Education. The Pennsylvania State University, University Park, Pennsylvania 16802.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

3.	Act as a rodman.		2.8
	a.	Mark and record measuring points using paints, stake, keel, or tacks.	2.9
	b.	Move rod, or target on rod, following instructions of instrumentman.	2.8
	c.	Call out readings to notekeeper, or write station number and reading in notebook.	2.7
4.	Act as chainman.		2.4
	a.	Measure distances between survey points using cloth or steel tape, or surveyor's chain.	2.9
	b.	Use tape supports or tension meters.	2.6
	c.	Set taping arrows.	2.4
	d.	Check tape calibration by comparison with master tape.	2.3
	e.	Cut and clear brush from survey line.	2.3
	f.	Set traffic warnings.	2.3
	g.	Act as a flagman.	2.1
5.	Act as instrumentman.		2.8
	a.	Measure elevations using altimeter, level, or transit.	2.9
	b.	Measure angles between survey points using compass or transit.	2.9
	c.	Measure distances between survey points using transit.	2.7
	d.	Direct rodman by voice or hand signals.	2.7
	e.	Maintain surveying instruments.	2.6
6.	Act as notekeeper.		2.9
	a.	Record all distances, angles and elevations measured.	3.1
	b.	Make simple arithmetic calculations.	3.1
	c.	Calculate simple closures of level circuits and slope corrections.	3.1
	d.	Draw field sketches of area using map symbols.	2.9
	e.	Solve simple trigonometric problems.	2.7
	f.	Prepare daily record of activities.	2.7
	g.	Record corrections for declination and climatic factors.	2.6
7.	Compile data for planning studies.		2.7
	a.	Gather area maps.	2.9
	b.	Relate aerial photographs to topographic maps.	2.9
	c.	Compile economic, geographic, and other literature pertinent to area.	2.7
	d.	Gather name and boundary information.	2.7
	e.	Report on area movement concerning traffic flows, population, business, and agriculture.	2.4

	f. Observe and report on available facilities and needs for housing, parking, recreation, and education.	2.2
8.	Perform clerical office work.	2.8
	a. Transpose field notes and sketches to topographic maps.	2.8
	b. Transpose approved field notes to map symbols.	2.8
	c. Aid in preparing tracing of topographic area.	2.8

LAND USE PLANNING TECHNICIAN

Other Titles: Planning Assistant, Landscape Craftsman, Cartographer, Planner I.

Job Description:

The Land Use Planning Technician compiles and summarizes data collected from maps, reports, field investigations, and books for planning and zoning studies; prepares illustrations concerning population, transportation, zoning, land use, proposed sub-divisions, and public utilities for planning studies; makes charts, graphs, tabulations, detailed drawings, and tracings; prepares blueprints; forms photogrammetric mosaics of areas; forecasts area movements of business, population, industry, and agriculture; assists in the preparation of three-dimensional relief maps.

Competencies Identified and Validated

N = 34*

Competencies	Weighted Mean**
1. Compile data for planning studies.	2.9
a. Collect information on area topography, such as soil types, land features, electric, and telephone lines, and road systems.	3.4
b. Study aerial photographs and topographic maps of area.	3.4
c. Investigate existing land use.	3.4
d. Determine existing and proposed zoning, subdivisions, and activities.	3.3
e. Assemble data on population growth.	3.1
f. Read and summarize reports.	2.9
g. Study existing public utilities and projected needs.	2.8
h. Survey existing recreational facilities and projected needs.	2.7
i. Evaluate traffic movements and systems.	2.4
j. Survey public and merchandise transportation.	2.4
k. Survey educational facilities and project needs.	2.4
2. Prepare illustrations for planning studies.	3.2
a. Tabulate field investigation reports.	3.5

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* Responses from 34 Land Use Planning Technicians in 17 states. Survey conducted by Department of Agricultural Education, The Pennsylvania State University, University Park, Pennsylvania 16802.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

	b.	Secure map data from files.	3.3
	c.	Graph inter-related planning concerns, such as population, traffic, etc.	3.0
	d.	Chart movement of people, business. etc., within an area.	2.8
3.	Prepare detailed sketches and drawings.		2.6
	a.	Interpret sketches, diagrams, topographic, and planimetric maps.	3.2
	b.	Select scales and determine scaled dimensions.	3.0
	c.	Prepare tracings and blueprints using light table and mimeoscope.	2.8
	d.	Interpret aerial photographs.	2.8
	e.	Plot distances and elevations.	2.7
	f.	Classify and show roads, buildings, and woodlands.	2.7
	g.	Sketch contours.	2.6
	h.	Use standard engineering handbooks, guides, designs, and procedures in selecting and adapting practices to fit local positions.	2.6
	i.	Apply design specifications.	2.5
	j.	Determine radii and point locations from specifications and field notes.	2.5
	k.	Use mathematics, conversion tables, and slide rules.	2.4
	l.	Run lines of stadia traverse.	1.6
4.	Apply land use conservation principles.		2.3
	a.	Report on needs for educational and recreational facilities.	2.4
	b.	Determine projected needs for public utilities.	2.2
5.	Have proficiency in mechanical drafting techniques.		2.5
	a.	Draw lines and parallels using straight edge and T-square.	2.6
	b.	Measure scaled distances and radii using compasses and calipers.	2.6
	c.	Use templates and lettering guides for precision work.	2.6
	d.	Draw preliminary and final lines and letters using lead and lead holders, pens, brushes, and ink.	2.6
	e.	Measure angles and draw parallel lines not parallel or perpendicular to the T-square.	2.5
	f.	Reproduce drawings by tracing or blueprints using light-tables, mimeoscopes, diazo equipment, spirit duplicators, and other devices.	2.5
	g.	Lay out and ink lines and letters using brushes and pens to produce lines of varying weight, according to the scaled drawing size.	2.4

6.	Perform cartographic work.		1.6
	a.	Compile routine features such as road systems, drainage systems, and sparsely populated areas.	2.2
	b.	Measure distances between reference points and establish exact relative distances using a compass or other device.	1.9
	c.	Scribe color-separation drawings.	1.8
	d.	Form photogrammetric mosaics of areas, maintaining precise scaled distances.	1.7
	e.	Assemble and index uncontrolled mosaic.	1.6
	f.	Apply photovision techniques.	1.6
	g.	Convert grid values of geodesic positions to values suitable for base scale of base sheet.	1.6
	h.	Erase obsolete chart details and hand stamp new details.	1.6
	i.	Compile and adjust contours by extraction and interpolation.	1.5
	j.	Perform elementary compilation-scribing.	1.5
	k.	Pick and transfer center and pass points using a steroscope for slotted template control procedures.	1.4
	l.	Operate contact printer, sort and dry prints.	1.4
7.	Assist in the preparation of three-dimensional relief models.		2.0
	a.	Determine scaled distances from photomosaics, maps, and specifications.	2.2
	b.	Draft scaled dimensions on materials to be cut.	1.9
	c.	Detail appropriate areas with inks or paints.	1.9
	d.	Cut and mount materials onto backing board.	1.8
8.	Supervise non-professional and temporary field personnel.		2.4
	a.	Interpret directions and plans.	3.0
	b.	Train new personnel.	2.4
	c.	Demonstrate an understanding of the tasks performed by all employees under his supervision.	2.4
	d.	Enforce employee safety regulations and standards.	2.2
	e.	Plan and supervise work schedules.	2.2

ZONING COMPLIANCE OFFICER

Other Titles: Zoning Inspector, Zoning Technician.

Job Description:

The Zoning Compliance Officer inspects the uses of land and buildings to assure their compliance with local and state ordinances; works with owners in pre-renovation planning; issues building and occupancy permits; inspects buildings under construction for proposed usage, adherance to standards of engineering and architecture, and compliance with safety regulations; handles zoning change requests.

Competencies Identified and Validated

N = 48*

Competencies		Weighted Mean**
1.	Issue zoning permits and inspect for regulation compliance.	3.2
a.	Check zoning ordinances for usage compliance.	3.8
b.	Make decisions based on interpretations of rules and regulations.	3.6
c.	Check sizes of courts, yards, and other open spaces.	3.4
d.	Inspect location and use of buildings, structures, and land for trade, industry, residence, or other purposes.	3.4
e.	Record appropriate data.	3.4
f.	Check height, number of stores, and size of building.	3.3
g.	Regulate lot percentage that building occupies.	3.1
h.	Check for compliance of sub-division of municipalities into districts of such number, shape, and area as may be best suited to carry out the purposes of land-use planning specified by the zoning regulations.	3.1
i.	Collect necessary fees.	2.7
j.	Check the population density by use in relation to lot size.	2.5
2.	Inspect existing structures, and structures under construction for compliance with applicable ordinances, laws, and regulations.	3.2

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* Responses from 48 Zoning Compliance Officers in 18 states. Survey conducted by Department of Agricultural Education. The Pennsylvania State University, University Park, Pennsylvania 16802.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

a.	Re-inspect to check for compliance.	3.3
b.	Refer items of non-compliance to proper authorities for further action.	3.3
c.	Recommend necessary action to correct discrepancies.	3.2
d.	Officially notify owners in writing of the discrepancies noted.	3.2
e.	List all discrepancies and non-compliance.	3.1
3.	Issue building permits.	3.0
a.	Check zoning ordinances to see if construction conforms with land use.	3.5
b.	Make decisions based on interpretations of laws and ordinances.	3.2
c.	Record appropriate data.	2.9
d.	Collect necessary fees.	2.9
e.	Inspect plans for compliance with safety and architectural standards.	2.1
4.	Enforce zoning ordinances.	2.9
a.	Inspect for compliance with regulations concerning lot size, and location of building on lot with regard to set backs from public right-of-way, side yards, and rear yards.	3.6
b.	Interpret laws and regulations as an enforcement guide.	3.4
c.	Testify in civil suits.	2.9
d.	Issue summonses for violations.	2.5
e.	Recommend condemnation for buildings if unfit for human habitation.	2.2
5.	Give advice on pre-construction planning.	3.1
a.	Familiarize owners with ordinances affecting them.	3.3
b.	Interpret ordinances as a planning guide.	3.1
c.	Make necessary recommendations.	2.9
6.	Handle zoning variances.	2.8
a.	Make decisions based on ordinances.	2.9
b.	Process requests for variance.	2.7
c.	Testify at hearings.	2.7
7.	Receive requests for zoning changes.	2.7
a.	Review and interpret existing regulations.	2.9
b.	Collect materials concerning proposed change.	2.7
c.	Process requests for changes.	2.5
d.	Testify at hearings.	2.5

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8.	Issue occupancy permits.	2.4
a.	Use laws and regulations in decisions.	3.0
b.	Inspect building to see that occupancy conforms with use.	3.0
c.	Collect necessary fees.	2.3
d.	Verify perculation tests for sewerage lines.	2.3
9.	Prepare records and reports.	3.2
a.	Submit reports to officials as requested.	3.5
b.	Keep records of permits issued and fees collected.	3.2
c.	Process and record zoning variance and zoning change requests, and their outcomes.	3.2
d.	Record data of all inspections made.	3.1
e.	Keep records of summonses issued.	3.0

COMMERCIAL FISHERMAN

Other Titles: Commercial Salmon Troller, Deck Hand, Boat Puller, Owner, Operator, Captain, Draggerman, Sternman.

Job Description:

Handles small and large boats; knowledgeable about dead reckoning; piloting and electronic navigation; ties knots and splices and repairs nets; knowledgeable about fishing operations, fishing gear and the fishing business; is an able seaman; understands Coast Guard rules and regulations.

Competencies Identified and Validated

N = 39*

	Competencies	Weighted Mean**
1.	Recognize the differences in fishing vessels such as Steel Otter Trawler, Boston Trawler, Salmon Gill Netter, Chesapeake Bay Skipjack, Shrimp Trawler, Pacific Dragger, and Purse Seiner (Tuna).	2.0
a.	Navigate different types of vessels.	2.5
b.	Understand location where each boat is used.	2.0
c.	Understand use of each.	2.0
2.	Prepare, maintain and use fishing gear such as fish weir, purse seine, pound net, longline set, gill net, otter trawl, tongs, lobster traps.	2.9
a.	Understand use of equipment.	3.4
b.	Build, maintain, and repair equipment.	3.4
c.	Adjust gear under field conditions for maximum efficiency.	3.2
d.	Use other fishing gear such as fishing poles.	1.5
3.	Use navigation and communication equipment.	3.1
a.	Recognize piloting to navigational markers and signals.	3.6
b.	Pilot a boat using navigational charts.	3.2
c.	Use dead reckoning.	3.1
d.	Use electronic navigation devices.	3.0
e.	Use a ship-to-shore and short-wave radio.	3.0
f.	Understand national and international rules of the sea.	2.9

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* Responses from 39 Commercial Fisherman in 13 states. Survey conducted by Department of Agricultural Education, The Pennsylvania State University, University Park, Pennsylvania 16802.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

4.		Tie knots and splices.	3.3
	a.	Tie common knots such as a square knot, a half hitch, bowline, clove, etc.	3.5
	b.	Know how to inspect rope for wear or damage that impairs safe use.	3.4
	c.	Repair nets using appropriate knots and splices.	3.3
	d.	Know rope kinds and sizes and appropriate selection for particular use.	2.9
5.		Be an able seaman.	3.0
	a.	Use safety procedures regarding all aspects of fishing.	3.5
	b.	Use ship machinery such as winches, engines and pumps.	3.3
	c.	Operate machinery under a variety of sea conditions.	3.2
	d.	Be familiar with basic first aid principles.	2.8
	e.	Swim well.	2.2
6.		Understand legal and safe operation of vessels.	3.1
	a.	Maintain a boat in safe condition.	3.2
	b.	Obey fishing regulations in specific areas.	3.1
	c.	Understand Coast Guard rules and regulations.	2.9
7.		Understand fishing laws.	2.8
	a.	Know fishing season for specific species of fish for his area.	3.2
	b.	Know which fish are illegal to catch.	3.0
	c.	Know where polluted non-fishing areas are.	2.4
8.		Recognize species of fish and their habits.	3.0
	a.	Remove undesirable species of fish from catch.	3.2
	b.	Know where desirable fish live.	3.0
	c.	Understand fish schooling and migration.	2.9
9.		Use basic fish preservation techniques.	3.3
	a.	Know use of either refrigeration or ice for preservation techniques.	3.3
	b.	Check for fish quality on long voyage.	3.3
	c.	Maintain proper cooling temperature.	3.2
10.		Use and understand use of various baits.	2.2
	a.	Know which bait is best for certain species of fish.	2.5
	b.	Understand technique of chumming.	1.8
11.		Keep up-to-date with fish marketing information.	2.3
	a.	Understand factors of supply and demand.	2.5
	b.	Check on daily, weekly, and seasonal price lists for fish.	2.4

c.	Have a knowledge of sources of credit and means of application.	2.3
d.	Know the government agencies that serve agriculture (USDA, FDA, ICC, PUC, ASCS).	2.0
12.	Keep records of catches.	2.3
a.	Record where fish are taken.	2.4
b.	Record types of fish taken.	2.3
c.	Record poundage of fish taken.	2.3

FISHERIES TECHNICIAN - MARINE

Other Titles: Conservation Helper, Aquatic Biologist, Fisheries Biologist, Fisheries Scientist, Fish Fieldman, Natural Resource Technician I, Fish Management Specialist.

Job Description:

Works with scientists in investigations carried out in salt or brackish water fisheries; collects fish scales and otoliths; takes population surveys; uses tagging procedures; surveys growth beds in sea farms and helps keep predators from beds; assists in the design and construction of fishing gear; assists in preparation and maintenance of algae and mollusk culture studies; assists in construction of collecting gear associated with mariculture operations; uses scuba diving techniques for collection and observation of fish and shellfish.

Competencies Identified and Validated

N = 35*

Competencies	Weighted Mean**
1. Assist scientists in investigations and reports.	3.1
a. Collect samples.	3.3
b. Prepare equipment for experiments.	3.3
c. Conduct population census.	3.1
d. Collect fish scales and otoliths.	2.8
2. Supervise non-professional and field personnel.	3.1
a. Interpret directions and plans.	3.3
b. Enforce employee safety regulations and standards.	2.9
3. Prepare algae and mollusk cultures.	2.0
a. Use proper laboratory procedures in working with sterile equipment for culture media.	2.4
b. Prepare sterile water and chemical nutrients.	1.9
c. Know nutrients required by algae.	1.7

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* Responses from 35 Fisheries Technicians in 13 states. Survey conducted by Department of Agricultural Education, The Pennsylvania State University, University Park, Pennsylvania 16802.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

4.	Recognize different kinds of shellfish predators (starfish, oyster drill, moonsnail, whelki) and know proper controlling procedures.	1.4
	a. Remove starfish with starfish mop.	1.4
	b. Remove predators with quick lense.	1.3
5.	Tag fish and shellfish.	2.8
	a. Apply tags.	2.8
	b. Recognize different types of tags.	2.7
6.	Use special nets, seines, dredgers, bottom samplers, and water samplers.	2.7
	a. Assist in maintenance.	3.1
	b. Assist in construction.	2.7
	c. Assist in design.	2.3
7.	Help operate mariculture experiments.	1.9
	a. Collect matured shellfish.	2.0
	b. Collect spat.	1.9
	c. Place shellfish in bed.	1.8
	d. Fertilize shellfish.	1.7
8.	Use scuba diving equipment.	2.8
	a. Swim well.	3.0
	b. Practice safety procedures.	3.0
	c. Use equipment properly.	2.9
	d. Recognize different types of scuba equipment.	2.2
9.	Operate small craft.	3.1
	a. Practice water safety.	3.6
	b. Maintain equipment.	3.4
	c. Practice coast guard regulations.	2.3

CAMPGROUND MANAGER

Other Titles: Camp Coordinator, Resident Manager, Superintendent of Parks, Camping Director, Park Maintenance Supervisor.

Job Description:

Supervises the campground maintenance person's weekly work schedule, prepares the weekly camp programs, orders supplies, manages the campground accounts and records, makes periodic reports, schedules camp sites, monitors the safety and health of camp visitors, enforces campground regulations, interprets campground policies and serves as a public relations person for the campground.

Competencies Identified and Validated

N = 32*

Competencies		Weighted Mean**
1.	Supervises activities of the campground maintenance person and temporary field personnel.	3.4
a.	Interpret directions and plans.	3.7
b.	Maintain open communications with employees and administrators.	3.6
c.	Enforce employee safety regulations and standards.	3.5
d.	Plan and supervise work schedules.	3.5
e.	Demonstrate a general understanding of the tasks performed by all employees under his supervision.	3.5
f.	Train new personnel.	3.4
g.	Interpret appropriate federal, state, and local labor laws.	3.3
h.	Maintain working conditions under existing contract agreements.	3.2
2.	Schedule the weekly campground activities of visitors and employees.	1.7
a.	Prepare daily and long range maintenance plans.	3.0
b.	Call in private contractors when necessary.	2.5
c.	Provide local entertainment.	1.2
d.	Invite guest craftsmen to the camp.	1.2
e.	Prepare craft workshops.	1.1

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* Responses from 32 Campground Managers in 20 states. Survey conducted by Department of Agricultural Education. The Pennsylvania State University, University Park, Pennsylvania 16802.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

f.	Schedule camp sporting events.	1.1
3.	Order weekly campground supplies.	2.6
a.	Order parts for camp equipment, including those recommended by the camp maintenance person.	3.0
b.	Maintain camp food supplies.	2.5
c.	Maintain camp medical supplies.	2.3
4.	Manage the campground accounts and records and make periodic reports.	2.7
a.	Keep weekly records of campground money.	3.0
b.	Account for all campground money.	3.0
c.	Make periodic reports to the campground owner and discuss camp finances.	2.9
d.	Handle all incoming money from the campground facilities.	2.8
e.	Sell the camp visitors overnight stickers.	1.7
5.	Schedule camp site use.	2.8
a.	Explain the policies of the campground.	3.3
b.	Check their arrival and departure times.	2.8
c.	Assign campers to specific camp sites.	2.7
d.	Give the campers a map of the campgrounds.	2.3
6.	Monitor the safety and health of camp visitors.	2.8
a.	Use established fire-fighting techniques.	3.2
b.	Protect the campers from dangerous animals and other hazards.	3.1
c.	Recognize the need for medical assistance.	3.1
d.	Be certified to administer first-aid.	2.6
e.	Recognize certain signs of physical fatigue.	2.0
7.	Enforce campground regulations.	3.1
a.	Explain camp rules when necessary.	3.4
b.	Call local or state police for assistance.	3.3
c.	Direct camp visitors to specific areas.	3.0
d.	Patrol campground areas.	2.9
8.	Perform public relations work.	2.0
a.	Explain general program and specific objectives of programs to individuals and groups.	2.7
b.	Prepare informative reports and other literature for public use.	2.3
c.	Act as a resource person in program area.	2.0
d.	Write news releases.	1.7
e.	Participate in radio and TV programs.	1.2

CAMPGROUND MAINTENANCE PERSON

Other Titles: Parks Worker, Regional Supervisor - Forest and Parks, Park Maintenance Worker I, Park Caretaker, Park Superintendent.

Job Description:

The Campground Maintenance Person has above average skills in the areas of plumbing, electricity, carpentry, and masonry. This person maintains campground buildings and facilities, as well as the turf and forested area around the campground. Small equipment maintenance and repair, swimming pool maintenance, and administering first-aid, are also part of this individual's work.

Competencies Identified and Validated

N = 32*

Competencies	Weighted Mean**
1. Maintain and repair the camp water system.	2.7
a. Recognize any damage to the water system.	3.6
b. Repair damaged water futures and lines.	3.5
c. Maintain the water system.	3.3
d. Call a plumber when the need arises.	2.8
e. Maintain the camp water pumps.	2.8
f. Check and control algae growth in the water source.	2.1
g. Collect water samples for state evaluation monthly.	1.8
h. Conduct chlorination of drinking water periodically.	1.7
2. Maintain and repair the camp sewage system.	2.8
a. Recognize damage or problem in the sewage system.	3.6
b. Call for assistance when needed.	3.6
c. Maintain the sewage system.	3.2
d. Be licensed to operate a treatment plant when applicable.	0.8
3. Maintain and repair camp structures and follow a scheduled maintenance and repair program.	2.9
a. Make general repairs.	3.6

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* Responses from 32 Campground Maintenance Persons in 20 states. Survey conducted by Department of Agricultural Education. The Pennsylvania State University, University Park, Pennsylvania 16802.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

b.	Paint camp buildings, benches, tables, chairs, signs, and bridges.	3.4
c.	Build new camp buildings, benches, tables, chairs, signs, and bridges.	2.3
d.	Maintain craft and sports equipment.	2.2
4.	Maintain and repair walks, parking areas, roads, and campsites.	2.8
a.	Maintain and repair campsites.	3.3
b.	Make minor repairs to walks, parking areas, and roads.	2.9
c.	Maintain gravel, asphalt, and non-paved roads.	2.8
d.	Mix concrete.	2.6
e.	Pour concrete and finish cement.	2.5
5.	Maintain sanitary conditions.	2.7
a.	Remove rubbish from the campground areas.	3.6
b.	Maintain and disinfect comfort facilities.	3.2
c.	Maintain and clean bath houses.	2.9
d.	Control rodents.	2.8
e.	Apply insecticides to control mosquitos, flies, and ants.	2.7
f.	Be licensed to apply chemicals.	0.8
6.	Mow lawns, open fields, and grassed play areas.	3.0
a.	Use safety standards relating to the operation.	3.3
b.	Become familiar with the operator's manual for each piece of equipment.	3.2
c.	Adjust equipment under field conditions for maximum efficiency.	3.0
d.	Prepare machines and equipment for storage.	3.0
e.	Service mowing machinery and equipment.	2.9
f.	Attach accessory equipment to a basic power unit.	2.8
7.	Repair small equipment.	3.2
a.	Recognize malfunctions in small equipment.	3.4
b.	Make repairs as needed.	3.2
c.	Order replacement parts.	3.2
d.	Recommend major repairs and the need for assistance.	3.2
e.	Recommend acquisitions of new equipment.	3.0
8.	Control and clear weeds including poisonous plants.	2.0
a.	Mow weeds.	2.7
b.	Use a scythe and other brush clearing tool.	2.5
c.	Be licensed to apply herbicides.	1.0

9.		Treat damaged trees and shrubs for insects and diseases.	2.2
	a.	Remove dead trees and limbs.	2.7
	b.	Recognize tree insects, diseases, and their effects.	2.0
	c.	Spray trees for insects and diseases.	2.0
10.		Maintain and repair the camp swimming pool.	1.7
	a.	Check the pool for physical hazards.	2.0
	b.	Recognize any damage to the pool.	1.9
	c.	Use lifesaving equipment.	1.6
	d.	Check the chlorine content of the water.	1.6
	e.	Winterize the pool.	1.5
	f.	Clean the pool daily.	1.5
11.		Monitor safety and health of camp visitors.	2.4
	a.	Recognize the need for medical assistance.	3.0
	b.	Protect the campers from various animals and other hazards.	2.7
	c.	Identify poisonous plants and snakes.	2.5
	d.	Perform artificial respiration.	2.4
	e.	Be certified to administer first-aid.	2.3
	f.	Recognize certain signs of physical fatigue.	2.2
	g.	Organize search parties.	1.4
12.		Use established fire-fighting techniques.	3.3
	a.	Call for assistance.	3.6
	b.	Use an axe, chainsaw, and shovel.	3.5
	c.	Extinguish flames and embers.	3.4
	d.	Suppress fire by felling trees.	2.5

PARK AIDE

Other Titles: Park Worker, Park Groundskeeper, Groundskeeper.

Job Description:

Works directly under the Park Maintenance Person. This person mows the grass, clears weeds, treats trees, and maintains any established existing planting beds. Also, the job includes building and comfort station maintenance, minor repair of park equipment, fire-fighting, enforcing the law, and assisting park visitors.

Competencies Identified and Validated

N = 40*

Competencies	Weighted Mean**
1. Mow lawns, open fields, and grassed play areas.	3.0
a. Use safety standards relating to the operation of a particular piece of machinery.	3.4
b. Recognize malfunctions in equipment.	3.1
c. Service machinery and equipment according to the operator's manual.	3.0
d. Become familiar with operator's manual for each piece of equipment.	3.0
e. Adjust equipment under field conditions for maximum efficiency.	2.9
f. Attach accessory equipment to basic power unit.	2.8
g. Prepare machines and equipment for storage.	2.6
2. Control and clear weeds including poisonous plants.	2.0
a. Mow weeds.	2.8
b. Use a scythe and other brush clearing tools.	2.6
c. Apply herbicides.	2.4
3. Treat damaged trees and shrubs for insects and disease.	2.4
a. Remove dead trees and limbs.	2.9
b. Recognize tree insects and diseases and their effect.	2.2
c. Spray trees for insects and disease.	2.2

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* Responses from 40 Park Aides in 15 states. Survey conducted by Department of Agricultural Education, The Pennsylvania State University, University Park, Pennsylvania 16802.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

4.	Establish and maintain planting beds.		2.0
	a.	Mulch plants.	2.1
	b.	Dig the soil.	2.0
	c.	Prepare the soil for planting.	2.0
	d.	Remove dead plants and plant new ones.	2.0
	e.	Plant flowers.	1.9
	f.	Weed and hoe flowers.	1.8
5.	Cut and maintain trails.		2.9
	a.	Remove fallen trees.	3.0
	b.	Remove small brush.	3.0
	c.	Use chain saw, axe, and brush hook.	2.9
	d.	Maintain trail surface.	2.8
6.	Maintain sanitary conditions.		2.9
	a.	Maintain and disinfect comfort facilities.	3.3
	b.	Remove rubbish from the park areas.	3.2
	c.	Maintain and clean bath houses.	3.0
	d.	Apply insecticides to control mosquitoes, flies, and ants.	2.2
7.	Maintain and repair benches, tables, chairs, and signs.		2.8
	a.	Replace broken parts.	3.0
	b.	Paint existing benches, tables, chairs, and signs.	2.9
	c.	Use small hand tools.	2.9
	d.	Build new benches, tables, chairs, and signs.	2.3
8.	Maintain and repair roads and park walks.		2.6
	a.	Sweep walks.	2.7
	b.	Patch holes in the roads.	2.7
	c.	Clear ditches along roads.	2.6
	d.	Clear snow.	2.5
	e.	Help build new roads and walks.	2.3
9.	Maintain park water systems.		3.0
	a.	Report plumbing problems.	3.5
	b.	Recognize plumbing problems.	2.9
	c.	Assist in repair of plumbing problems.	2.6
10.	Answer questions and assist visitors.		2.7
	a.	Interpret park rules and regulations.	3.1
	b.	Direct visitors to points of interest.	3.1
	c.	Protect the park from negligent people.	3.1
	d.	Enforce park regulations.	2.3
	e.	Direct traffic.	2.1

11.	Maintain and repair park buildings.	2.6
a.	Make minor repairs.	3.0
b.	Paint buildings.	2.8
c.	Mix and pour concrete.	2.4
d.	Help build new buildings.	2.1
12.	Use established fire-fighting techniques.	3.3
a.	Report fires.	3.7
b.	Use and maintain fire tools and equipment.	3.2
c.	Apply first-aid techniques.	3.1

PARK MAINTENANCE PERSON

Other Titles: Park Technician, Park Information Technician.

Job Description:

Enforces park rules and regulations as well as interpreting them; directs park registration and assigns camper facilities; maintains the water supplies and facilities, toilet facilities, park buildings, trails, shrubs, and trees, turf areas, and playground equipment; assists campers and constructs certain equipment (tables and benches) as the need arises; administers first-aid, organizes search parties, fire-fighting squads, and supervises the Park Aide or Aides.

Competencies Identified and Validated

N = 47*

	Competencies	Weighted Mean**
1.	Understand and interpret park rules and regulations.	2.2
a.	Assist visitors concerning park rules.	3.0
b.	Patrol park grounds.	2.3
c.	Enforce park rules.	2.3
d.	Call state or local police enforcement agencies.	2.1
e.	Direct traffic.	2.0
f.	Supervise camper facility assignments.	2.0
2.	Monitor safety and health of park visitors.	2.7
a.	Recognize hazards to visitors.	3.4
b.	Call for medical assistance.	3.0
c.	Be certified to administer first-aid.	2.8
d.	Perform artificial respiration.	2.7
e.	Identify poisonous plants and snakes.	2.6
f.	Recognize certain signs of physical fatigue.	2.5
g.	Organize search parties.	2.2
3.	Maintain and repair park facilities at a sub-journeyman level and follow a scheduled maintenance and repair program.	3.2
a.	Maintain and repair water systems.	3.3
b.	Maintain and repair sewage systems.	3.3

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* Responses from 47 Park Maintenance Persons in 18 states. Survey conducted by Department of Agricultural Education, The Pennsylvania State University, University Park, Pennsylvania 16802.

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	c.	Maintain and repair park buildings and comfort facilities.	3.3
	d.	Maintain and repair electrical systems.	3.2
	e.	Maintain trails and walks.	3.1
	f.	Maintain and repair concrete and masonry.	3.0
	g.	Maintain and repair mowing equipment.	3.0
	h.	Maintain grass and trees in the park.	3.0
4.		Supervise the Park Aide(s).	3.1
	a.	Interpret directions and plans.	3.2
	b.	Demonstrate a general understanding of the tasks performed by all employees in this area of work.	3.2
	c.	Enforce department employee safety regulations and standards.	3.1
	d.	Plan and supervise work schedules.	2.9
	e.	Train new personnel.	2.9
	f.	Maintain working conditions under existing contract.	2.9
5.		Use carpentry and masonry skills.	3.0
	a.	Use small hand tools.	3.3
	b.	Use a hammer, saw, power saw, square, and level to construct park structures.	3.2
	c.	Read a blueprint or sketch.	2.8
	d.	Build and repair block structures in the park.	2.6
6.		Organize rubbish removal and park sanitation.	2.9
	a.	Check showers and comfort stations for sanitation.	3.3
	b.	Supervise trash pick-up and disposal.	3.0
	c.	Present basic environmental practices to Park Aide(s) and visitors.	2.6
	d.	Warn campers about litter violations.	2.5
7.		Answer questions pertaining to the park.	2.8
	a.	Answer questions pertaining to the local area.	3.0
	b.	Point out interesting sites within the park.	2.9
	c.	Direct visitors to comfort stations.	2.9
	d.	Direct visitors to natural phenomenon.	2.5

HUNTING AND FISHING GUIDE

Other Titles: Camp Guide, Packer, Outfitter, Hunting Preserve Guide, Professional Guide.

Job Description:

This person is involved in planning and supervising hunting and fishing trips. The guide prepares itineraries, travel routes, equipment, food and provisions. The individual arranges for, and operates motor vehicles and watercraft, or handles horses used during trips. This person understands hunting and fishing laws, firearms use, and tackle and gear equipment needs. The guide selects campsites, prepares meals, and administers first-aid as part of the job.

Competencies Identified and Validated

N = 31*

Competencies	Weighted Mean**
1. Plan hunting and fishing trips.	2.9
a. Organize and lead the hunting or fishing parties.	3.6
b. Select specific areas for hunting or fishing to be done.	3.5
c. Estimate needs and select proper provisions to be used.	3.1
d. Map and plan trip routes.	2.8
e. Obtain proper licenses for members of the party.	2.8
f. Plan trip itineraries.	2.7
g. Arrange for lodging or camping areas.	2.7
h. Plan and provide methods of transportation.	2.6
i. Estimate cost of trips.	2.3
2. Use and understand firearms, gear, tackle, and other equipment used on trips.	3.2
a. Supervise safe use of equipment demonstrating proper safety rules of hunting and fishing.	3.6
b. Recommend the proper equipment to be used for the type of hunting or fishing to be done.	3.4

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* Responses from 31 Hunting and Fishing Guides from 18 states. Survey conducted by Department of Agricultural Education, The Pennsylvania State University, University Park, Pennsylvania 16802.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

c.	Demonstrate proper use of equipment.	3.1
d.	Make minor repairs on equipment broken on trip.	2.8
3.	Understand state hunting and fishing laws.	3.6
a.	Supervise the taking of proper species, size, and limits of fish and game.	3.8
b.	Keep aware of new law changes.	3.8
c.	Observe and prevent party members from violating laws.	3.6
d.	Explain the proper type of equipment that legally can be used in an area.	3.6
e.	Have a knowledge of public and private lands, and identify types of legal game.	3.6
f.	Inform group on the legality of using dogs, horses, or hunting birds in specific areas.	3.0
4.	Operate water craft and all terrain vehicles.	3.4
a.	Display proper safety habits in operation of craft and vehicles.	3.6
b.	Possess operator's license for all types of craft and vehicles to be used.	3.5
c.	Respect all boating laws.	3.5
d.	Maintain watercraft and vehicles in working order.	3.3
e.	Load all equipment properly.	3.3
f.	Read and interpret maps to obtain bearing or directions.	3.3
g.	Service equipment and make minor adjustments on trip.	3.2
5.	Display basic knowledge of common fish and game animals.	3.0
a.	Identify all species and sexes of desired game animals in area.	3.5
b.	Identify most desired food and habitat of fish and game.	3.1
c.	Display basic understanding of life cycle and mating habits.	2.7
d.	Identify game animals and their predators from tracks and other signs.	2.7
6.	Use pack animals and saddle stock.	2.8
a.	Demonstrate proper handling, care, and management of livestock and related equipment.	3.0
b.	Equip livestock with pack supplies and equipment for travel over all types of terrain.	2.7

7.	Maintain safety and health of the party.		2.8
	a.	Recognize signs of and prevent physical fatigue.	3.2
	b.	Be certified to administer first-aid.	3.1
	c.	Display proper life saving technique in aquatic situations.	3.0
	d.	Identify injuries and sicknesses and treat properly.	2.9
	e.	Display survival methods used on hunting and fishing trips.	2.8
	f.	Organize search parties.	2.5
	g.	Identify proper water and nature edible plants.	2.0
8.	Select and set up campsites.		2.8
	a.	Prepare meals.	2.9
	b.	Select proper sites for placing camps.	2.8
	c.	Set up tents and other shelters.	2.8
9.	Perform public relations work.		2.3
	a.	Explain trip programs and objectives to individuals and groups.	2.8
	b.	Estimate costs and prepare bills.	2.5
	c.	Prepare informative reports and nature talks for public.	1.6
10.	Use correct field dressing and preserving techniques of game.		3.5
	a.	Field dress and preserve game.	3.5

SOIL CONSERVATION AIDE

Other Titles: Conservation Aide, Biological Aide.

Job Description:

The Soil Conservation Aide assists in helping land owners and operators apply soil and water conservation practices, accompanies supervisor to the field and gathers data for development of conservation plans, performs simple work with a farm or hand level in laying out terraces or contour lines. Acts (as Rodman and Chainman) in surveying; from notes approved by supervisor, transposes information to aerial photographs, measures aerial photographs by use of planimeter and makes simple computations, colors land use capability maps and makes simple rough tracings of farm maps for use in preparing finished farm conservation maps, keeps daily records of activities, assists supervisor in working with land owners and operators in planting trees, grass seed, sod or stolons, as assigned, works on preparation and maintenance of accomplishment records and reports for the unit, and performs related duties as assigned.

Competencies Identified and Validated

N = 35*

Competencies		Weighted Mean**
1.	Gather field data for farm plans and conservation practices.	2.9
a.	Gather drainage area data.	3.4
b.	Locate and identify farm and field boundaries.	3.2
c.	Make simple sketches.	3.1
d.	Record physical and topographical data of farms.	3.1
e.	Record acreage in fields by making measurements and talking with landowners.	2.9
f.	Interpret basic soil differences.	2.8
g.	Determine cropping rotations and systems.	2.6
h.	Record the number and type of livestock.	2.1
2.	Lay out and inspect routine conservation practices.	3.2
a.	Assist in laying out contour strips, grass waterways, diversion terraces, and cropland terraces.	3.5

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* Responses from 35 Soil Conservation Aides in 16 states. Survey conducted by Department of Agricultural Education, The Pennsylvania State University, University Park, Pennsylvania 16802.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

	b.	Check compliance of conservation practices to specifications.	3.4
	c.	Assist and guide equipment operators in installing these routine practices.	3.1
	d.	Make recommendations of acceptability for applied conservation practices.	2.9
3.		Act as a chainman.	3.0
	a.	Mark measuring points with keel, paint, sticks, scratches, tacks, or stakes.	3.3
	b.	Measure distances between survey points, established or to be established, as directed by surveyor.	3.2
	c.	Use steel or cloth tape and surveyor's chain.	3.1
	d.	Cut and clear brush from survey lines.	2.6
4.		Act as a rodman.	3.4
	a.	Hold level rod or stadia rod at designated points.	3.6
	b.	Move rod or target on rod, following hand or verbal signals from instrument man.	3.5
	c.	Call out readings to notekeeper or write station number and reading in notebook when distance is too great from instrument man.	3.4
	d.	Carry and set stakes.	3.2
5.		Assist supervisor in working with landowners in planting trees, grass seed, sod, or stolons.	2.3
	a.	Distinguish between various tree and seed species.	2.6
	b.	Follow planting plan.	2.5
	c.	Use tree planting equipment and tools.	1.7
6.		Make cross-sections and profiles.	3.4
	a.	Measure distances between cross-sections.	3.4
7.		Compute volumes of earth for conservation practices.	2.9
8.		Transpose information from notes to aerial photographs.	3.0
	a.	Transpose approved field notes into map symbols.	3.0
9.		Measure aerial photographs with a planimeter.	3.3
	a.	Measure acreage.	3.4
	b.	Record measurements on photos or in records.	3.4
	c.	Use photo scales.	3.3

10. Make simple rough tracings of farm maps.	3.2
11. Color land use capability maps.	2.4
a. Use color codes of capability maps.	2.6
b. Ink soil survey field sheets.	2.0
12. Help to prepare and maintain accomplishment records and reports.	3.4
a. Prepare daily records of activities.	3.4

SOIL CONSERVATION TECHNICIAN

Other Titles: Land Use Technician, Soil Research Development Technician, Soil Engineering Technician, Roadside Development Technician, Biological Technician.

Job Description:

The Soil Conservation Technician is responsible for follow-up and maintenance activity on previously planned areas; guides and assists land owners and operators in the application and maintenance of conservation and group facility plans in light of changing conditions and serves as followup and maintenance technician on areas previously planned to insure continued compliance; makes simple adjustments in conservation practices when necessary, in accordance with standards set by planning technicians; makes surveys required for planning or application of conservation plans involving the use of hand level and tape; makes observations on the adequacy of applied practices as a result of cooperators' experience; aids land owners in pooling resources in order to establish and maintain conservation practices most efficiently; prepares necessary records and reports on work accomplished; supervises the work of assistants, and performs related duties as assigned. Usually employed by a governmental agency.

Competencies Identified and Validated

N = 31*

Competencies	Weighted Mean**
1. Collect soil samples.	2.8
a. Use an auger or probe and randomly collect core samples.	3.1
b. Complete field data sheet.	2.9
c. Record test pit information for building purposes.	2.5
2. Collect information for the development of farm or ranch conservation plans.	3.3
a. Determine significant erosion hazards and other problems related to the protection of the environment.	3.6
b. Locate and identify farm and field boundaries.	3.5

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* Responses from 31 Soil Conservation Technicians in 20 states. Survey conducted by Department of Agricultural Education. The Pennsylvania State University, University Park, Pennsylvania 16802.

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	c.	Use topographical and aerial photographs.	3.5
	d.	Service referral requests from ASCS.	3.4
	e.	Record acreage in field by making measurements and talking with land owners.	3.2
	f.	Gather drainage area data for watersheds.	3.2
	g.	Record physical and topographical data.	3.1
	h.	Determine cropping rotation and systems.	3.0
	i.	Record the number and type of livestock.	2.9
3.		Perform preliminary survey and layout work.	3.3
	a.	Use hand level or engineering level and tape.	3.7
	b.	Determine volumes of earth.	3.6
	c.	Study general lay-of-the-land (site conditions).	3.6
	d.	Locate best site for engineering practices.	3.5
	e.	Measure degree of slope.	3.3
	f.	Interpret soils information.	3.3
	g.	Evaluate degree of erosion.	3.2
	h.	Make borings and vegetative studies of wet areas.	3.1
	i.	Procure simple easements.	2.2
4.		Explain or demonstrate methods of applying conservation practices to land owner.	3.0
	a.	Adapt conservation practices with modern farming methods.	3.3
	b.	Explain the use of various equipment for the installation of practices.	3.2
	c.	Differentiate between various seeding and land preparation methods.	3.1
	d.	Relate fertilizing techniques and practices.	3.1
	e.	Compare contour cultivation with conventional methods.	3.1
	f.	Indicate how terracing saves soil and water.	3.1
	g.	Show the importance of farm drains and water courses.	3.1
	h.	Indicate where tree planting is advisable.	3.0
	i.	Translate woodland improvement practices.	2.7
	j.	Interpret benefits of seasonal and other simple irrigation practices.	2.6
	k.	Compare various range practices.	2.5
5.		Prepare records and reports.	3.1
	a.	Keep daily record of work accomplished.	3.7
	b.	Maintain farm plan records.	3.2
	c.	Assist with annual report.	3.0
	d.	Write simple news reports.	3.0
	e.	Prepare requisitions.	2.8

6.	Supervise work of assistants.		3.1
	a.	Maintain open communications.	3.4
	b.	Help assistants set-up work schedules.	3.1
	c.	Provide technical information and data.	3.1
	d.	Provide human understanding as a first line supervisor.	3.0
7.	Serve as a follow-through and maintenance technician for established practices.		3.4
	a.	Discuss with land owners the success or failure of established conservation practices.	3.5
	b.	Make field observations of established practices.	3.5
	c.	Make recommendations for the improvement and maintenance of practices.	3.5
	d.	Make simple adjustments to practices when necessary.	3.4
	e.	Aid land owners in pooling resources in order to maintain conservation practices most efficiently.	3.1
8.	Use standard engineering handbooks, guides, designs, and procedures in selecting and adapting practices to fit local conditions.		3.7
	a.	Interpret design specifications and apply them.	3.7
	b.	Keep up-to-date with changing design specifications.	3.7
9.	Prepare land capability maps from soil maps and data.		3.0
	a.	Use soil map symbols.	3.4
	b.	Read and interpret aerial photos.	3.4
	c.	Use soil loss calculator.	2.1
10.	Meet frequently with land owners and operators.		3.3
	a.	Understand the basic crop and livestock practices of the area.	3.6
	b.	Practice basic public relations and human relations techniques.	3.5
	c.	Interpret land owner needs for conservation practices.	3.5
	d.	Evaluate information provided by land owners.	3.4
	e.	Assist in conducting tours.	2.6
11.	Resolve routine working problems.		3.6
	a.	Make decisions based on knowledge and fact.	3.6
	b.	Accept decision-making responsibility.	3.6

WATER TREATMENT PLANT OPERATOR

Other Titles: Water Plant Operator, Superintendent - Water Supply, Assistant Director - Water Operations.

Job Description:

The main task of a Water Treatment Plant Operator is to see that the water discharged from the plant is at the proper level of purification. The individual controls the flow of raw water into plant by starting and regulating operation of electric motors, pumps, and valves. Adds specific amounts of chlorine, florine, ammonia, lime, and/or other chemicals to disinfect, deodorize, and clarify water, or adjust automatic devices which admit chemicals in controlled dosages. Filters impurified water and pumps purified water into water mains. Determines acidity and color of the water through standard color reaction tests. Keeps a daily inspection of the plant, and controls the maintenance of the alarm system in the pumping stations and deep wells; and in the pumps and motors. Keeps written records on such things as health reports, amount of water pumped, and the water level in the wells, and/or reservoirs. A majority of Water Treatment Plant Operators require certification, usually from their state government.

Competencies Identified and Validated

N = 37*

Competencies		Weighted Mean**
1.	Monitor chlorinators.	3.3
a.	Check chlorinator flow rate.	3.7
b.	Take water samples to determine the chlorine and bacteria count.	3.6
c.	Record chlorine and water discharge daily.	3.5
d.	Check for chlorine gas leaks.	3.5
e.	Weigh the daily amount of chlorine used by the chlorinator.	3.3
f.	Send water samples to lab for analysis.	3.2
g.	Maintain chlorinators.	3.1
h.	Maintain booster pumps.	2.6
2.	Monitor fluorinators.	2.1
a.	Analyze florine content of a water sample using the color comparator.	2.6

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* Responses from 37 Water Treatment Plant Operators in 18 states. Survey conducted by Department of Agricultural Education, The Pennsylvania State University, University Park, Pennsylvania 16802.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

	b.	Wear a gas mask when adding floride to the solution tank.	2.4
	c.	Record water intake into the fluorinator.	2.1
	d.	Take a reading of the florine in the solution tank.	2.1
	e.	Determine amount of water that enters into the solution tank.	2.0
	f.	Add salt to clean pumps in the fluorinator house.	1.6
3.		Inspect pumping stations.	2.8
	a.	Record oil level of the pump.	3.0
	b.	Record 24 hour changes in pressure and flow meters.	3.0
	c.	Check deep well pumps daily.	2.9
	d.	Determine static water level in the pump.	2.8
	e.	Check pressure systems of booster pumps.	2.6
	f.	Control maintenance of the alarm systems.	2.5
4.		Inspect water tanks.	3.0
	a.	Check 24 hour charts for tank levels.	3.4
	b.	Record flow rate (in gallons per minute).	3.3
	c.	Check water level of tanks, and start auxilliary well if additional water is needed.	3.1
	d.	Check 7 day charts for tank levels.	2.7
	e.	Control maintenance of the alarm system.	2.7
5.		Inspect water reservoirs.	2.5
	a.	Take water sample.	2.9
	b.	Check reservoir for debris and dead animals.	2.6
	c.	Remove debris and dead animals.	2.5
	d.	Locate leaks in the reservoirs.	2.5
	e.	Recommend cleaning of the reservoirs.	2.2
	f.	Check condition of fences.	2.1
6.		Perform maintenance activities.	2.4
	a.	Maintain an overall inspection of the physical plant.	3.2
	b.	Recommend replacement of worn equipment.	3.0
	c.	Maintain and clean building.	2.9
	d.	Change oil in pumps.	2.9
	e.	Grease pumps.	2.9
	f.	Check electrical systems.	2.8
	g.	Maintain lawns, shrubs, and trees.	1.9
	h.	Remove snow during winter months.	1.5
	i.	Resurface roads.	0.9
7.		Locate and repair water mains.	2.5
	a.	Contact fellow workers over two-way radio about possible break.	2.7
	b.	Assist fellow workers in locating and repairing water main breaks.	2.3

WASTE WATER TECHNICIAN

Other Titles: Plant Bacteriologist, Superintendent of Waste Water, Waste Water Plant Operator.

Job Description:

The individual must make practical applications of the basic principles and laws of physics, chemistry, and the biological sciences, including the use of mathematics through analytical geometry, and calculus. Calculates percentages, ratios, and proportions; makes computations in arithmetic for recirculations of sludge from gallons to pounds. Changes 24 hour and weekly charts of integrated figures, and reads meters. Operates the equipment that is associated with the distribution of digested sludge, and keeps in condition odor control equipment. Assists the plant mechanic with repair work. Adjusts manual pumping controls, maintains chlorine application that disinfects sewage as it leaves the plant, and maintains chlorine residue. Works in grit removal, and maintains flow rates.

Competencies Identified and Validated

N = 37*

Competencies	Weighted Mean**
1. Compute figures on the circulation of sewage.	3.0
a. Apply parameters as indicated on the daily "Operator's Check List" provided on a shift-by-shift basis by the analyst.	3.3
b. Calculate percentages, ratios, and proportions.	3.1
c. Change 24 hour and weekly charts of integrated figures.	3.0
d. Convert cubic feet into pounds.	2.9
e. Convert sludge recirculation from gallons to pounds.	2.7
2. Analyze effluent.	3.2
a. Take chlorine residual test.	3.5
b. Take dissolved oxygen tests.	3.3
c. Determine BOD (Biological Oxygen Demand) of raw water.	3.0
d. Determine BOD (Biological Oxygen Demand) of discharged water.	2.9

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* Responses from 37 Waste Water Technicians in 19 states. Survey conducted by Department of Agricultural Education, The Pennsylvania State University, University Park, Pennsylvania 16802.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

3.	Perform maintenance activities.	2.1
a.	Maintain, lubricate, and repair various wastewater treatment plant equipment.	3.2
b.	Work with preventative maintenance procedures on plant equipment.	3.1
c.	Safeguard utility services and facilities.	2.6
d.	Maintain high pressure chlorination which includes piping chlorination and distribution systems.	2.4
e.	Perform cleaning duties throughout the plant, such as hosing down oil tanks and walk ways.	2.4
f.	Perform minor electrical repair as required in emergency situations.	2.3
g.	Calibrate, repair, maintain, and adjust various types of indicating and recording equipment.	2.2
h.	Maintain adequate inventory of spare parts.	2.2
i.	Perform general plumbing.	2.2
j.	Maintain a complete machinery history file on plant equipment which includes a cost breakdown of repairs.	2.2
k.	Maintain instrumentation in lab.	2.2
l.	Plan and install various pieces of new equipment.	1.8
m.	Use both electric and gas welding to repair, maintain, and improve various pieces of plant equipment.	1.6
n.	Cut grass and maintain trees and shrubs around the plant.	1.6
o.	Utilize vibration analyzer to diagnose equipment malfunctions not otherwise detectable.	1.5
p.	Check, adjust, and maintain the recording and integrating instrument used for billing purposes.	1.3
4.	Operate sludge circulation equipment.	2.8
a.	Check effluent pump operation.	3.3
b.	Draw sludge from collection hoppers throughout the plant.	3.2
c.	Adjust flow rate of the sludge recirculation and by-passing.	3.0
d.	Assist in operation of sludge thickner.	2.8
e.	Check odor control equipment.	2.7
f.	Adjust effluent pump rates.	2.6
g.	Recharge chemical feed tanks on both biological filtration and activated sludge.	2.3
5.	Work with grit removal.	2.7
a.	Remove grit from collection basins.	3.0
b.	Haul grit to disposal areas.	2.5

6.	Drive vehicles.	2.0
a.	Drive pick-up truck to secure needed parts and supplies.	2.4
b.	Drive plant tank truck in the distribution of digested sludge.	2.1
c.	Drive snow plow during winter months to clear roads around the plant.	1.4

CONSERVATION AIDE

Other Titles: Jr. Game Biologist, Game Propagator II, Private Shooting Ground Operator and Manager.

Job Description:

Assists in the operation of the game hatchery and general operation of a game farm. Maintains simple roads, trails and ditches on state or federal game lands. Aids wildlife manager or conservation officer in the disposing of nuisance stream obstructions, trapping game animals for experiments, trapping and banding game animals. Assists in maintaining a traveling wildlife exhibit. Plants farm-game habitat improvement plots. Aids in the operation of game animal checking stations during hunting seasons. Serves as a production assistant on state produced wildlife movies. Builds duck blinds on state hunting areas. Performs general building construction, maintenance and repair of buildings. Aids in fire prevention programs and fights fire on game forest lands and game areas. Aids wildlife managers and wildlife biologists in game surveys. Installs boundary fences and signs on game refuge lands. Supervises temporary employees as assigned. Performs preventative maintenance on conservation equipment. Usually employed by a governmental agency.

Competencies Identified and Validated

N = 43*

Competencies		Weighted Mean**
1.	Operate game farm and wildlife equipment.	2.9
a.	Use safety standards relating to operation of a particular piece of machinery.	3.4
b.	Service machinery and equipment according to operator's manual.	3.2
c.	Recognize malfunctions in equipment.	3.2
d.	Operate machinery and equipment under a variety of field conditions.	3.1
e.	Adjust equipment under field conditions for maximum efficiency.	3.0
f.	Become familiar with operator's manual for each piece of equipment.	2.9
g.	Attach accessory equipment to basic farm power unit.	2.9

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* Responses from 43 Conservation Aides in 19 states. Survey conducted by Department of Agricultural Education, The Pennsylvania State University, University Park, Pennsylvania 16802.

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	h.	Prepare machines and equipment for storage.	2.7
	i.	Maintain records of maintenance and repair on machinery and equipment.	2.5
	j.	Maintain a daily log of number of hours each piece of equipment is used.	2.4
2.		Measure and compute water flow.	1.2
	a.	Use stream flow meter.	1.2
	b.	Use conversion tables.	1.2
3.		Remove obstructions from ditches and streams.	2.2
	a.	Use general earth moving hand tools.	2.5
	b.	Operate earth moving equipment.	1.9
4.		Identify wildlife species.	2.7
	a.	Identify species of animals.	2.8
	b.	Identify species of birds.	2.7
	c.	Identify feed plants for animals and birds.	2.7
5.		Assist in maintaining a mobile wildlife exhibit.	2.1
	a.	Hold the required license for type of equipment operated.	2.5
	b.	Drive responsibly and defensively at all times.	2.4
	c.	Protect and secure load.	2.2
	d.	Perform minor repairs.	2.1
	e.	Maintain a favorable condition for live exhibit.	1.8
	f.	Erect or place wildlife exhibit.	1.5
6.		Aid in operation of game animal checking stations during hunting seasons.	3.0
	a.	Record location from which wildlife was taken.	3.1
	b.	Inquire about numbers, sizes, and species of game animals, game birds, fish, or shellfish taken.	3.0
	c.	Measure sizes and make visual checks for other biological data.	3.0
	d.	Interview sportsmen at assigned check points.	2.8
7.		Serve as a production assistant on state wildlife movies.	1.5
	a.	Perform duties as assigned.	1.6
	b.	Maintain wildlife animals.	1.5
8.		Perform general construction maintenance and repair of wildlife facilities.	2.3
	a.	Perform subjourneyman level skills in carpentry.	2.6
	b.	Clean and sanitize buildings used in wildlife areas.	2.6

c.	Perform subjourneyman level skills in electricity.	2.0
d.	Perform subjourneyman level skills in plumbing.	2.0
9.	Aid in fighting game land forest fires.	2.0
a.	Clear fire lanes by removing brush, trees, and ground litter.	2.1
b.	Patrol burned area after fire to watch for hot sparks.	2.1
c.	Suppress fire by felling trees, digging trenches, and extinguishing flames and embers, using axe, chain saw, shovel, and hand or engine driven pumps.	2.0
d.	Ignite back fires to hasten burnout of major fire.	2.0
e.	Operate fire-fighting equipment such as bulldozers and fireplows.	1.7
10.	Aid in the gathering and recording of wildlife data.	2.3
a.	Inventory number and species of wildlife.	2.7
b.	Inventory available feed for wildlife.	2.5
c.	Use rain gauge.	1.7
11.	Install boundary fences and signs on state game lands.	2.8
a.	Use hand tools where necessary to erect fences and signs.	3.1
b.	Use a prepared map to determine locations.	2.9
c.	Stretch wire fencing.	2.6
d.	Operate mechanical equipment to drive posts.	2.5
12.	Supervise temporary employees as assigned.	2.4
a.	Explain assignments to be done.	2.5
b.	Assign specific jobs.	2.5
c.	Evaluate jobs accomplished.	2.2

CONSERVATION OFFICER

Other Titles: Municipal Police Instructor, Game Protector, Game Warden, Waterways Patrolman, Game Conservation Officer, District Game Protector.

Job Description:

Patrols assigned area to prevent game law violations, enforces game laws, investigates reports of damages to crops and property by wildlife. Investigates reports of fish and game law violations and issues warnings and citations. Serves warrants. Makes arrests and prepares and presents evidence in court actions. Collects and reports information on condition of fish and wildlife in their habitat, availability of game food and cover, and suspected pollution of waterways. Recommends stocking procedures, limits seasons, and opening dates. Arranges for the disposition of game killed accidentally or illegally. Interprets fish and game laws, rules, and regulations to sportsmen in the field and addresses group meetings. Promotes and assists in the hunter program. Enlists sportsmen associations in programs such as lake and stream rehabilitation and game habitat improvement. Supervises and advises game feeding and propagation programs. Supervises the maintenance of equipment and buildings within a specific district. Trains workers in the operation of equipment used in district land management programs. Recruits and trains assistant conservation officers and/or labor crews. Maintains an office with complete files in all reports, records, and correspondence applicable to assigned district. Coordinates and enlists leases with land owners for land open to public activities. Conducts an effective predator control program. Usually employed by a state governmental agency.

Competencies Identified and Validated

N = 42*

Competencies	Weighted Mean**
1. Patrol assigned area.	3.8
a. Apprehend violators and take appropriate action.	3.9
b. Prevent game law violations.	3.8
c. Arrest violators.	3.8
2. Prepare cases for prosecution.	3.6

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* Responses from 42 Conservation Officers in 12 states. Survey conducted by Department of Agricultural Education, The Pennsylvania State University, University Park, Pennsylvania 16802.

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a.	Obtain evidence for legal action.	3.9
b.	Testify in legal action.	3.8
c.	Investigate hunting accidents.	3.7
d.	Understand previous legal cases and their findings.	3.5
e.	Obtain and serve warrants.	3.5
f.	Consult a legal opinion.	3.2
3.	Collect and record information on wildlife in the area assigned.	2.7
a.	Inventory species of wildlife in the assigned area.	2.3
b.	Determine physical conditions of wildlife.	2.7
c.	Evaluate wildlife habitat.	2.7
d.	Take census of wildlife killed in the assigned area.	2.7
e.	Inventory available feed for wildlife.	2.6
4.	Maintain wildlife population in assigned area.	2.2
a.	Recommend stocking procedures.	2.5
b.	Recommend hunting seasons to include limits and opening dates.	2.5
c.	Recommend maintenance of feeds and habit.	2.2
d.	Recommend placement of game refuges.	1.6
5.	Dispose of game animals killed accidentally or illegally.	2.6
a.	Pick up animals to be disposed.	2.8
b.	Contact companies or organizations to utilize the animal.	2.6
c.	Recommend placement of animal crossing signs.	2.5
6.	Interpret fish and game laws and rules and regulations.	3.6
a.	Explain game laws to individuals.	3.7
b.	Address sportsman's groups.	3.5
c.	Speak to non-hunting groups.	3.5
7.	Coordinate the hunter safety program.	3.0
a.	Train hunter safety instructors.	3.2
b.	Certify persons who have completed hunter safety program.	3.0
c.	Conduct classes in hunter safety.	2.9
d.	Distribute hunter safety information.	2.8
8.	Provide public relations for state game commission.	2.7
a.	Address audience interested in wildlife.	3.2
b.	Participate in radio and television programs.	2.9
c.	Maintain exhibits at fairs, sportsman's shows, and schools.	2.8

d.	Assist sportsman's clubs in lake, stream, and game land improvement.	2.8
e.	Write newspaper articles for publication.	2.7
f.	Assist sportsmen in game feeding projects.	2.7
9.	Train deputy game wardens, part-time labor crews, and part-time equipment operators.	2.8
a.	Conduct new worker orientation.	2.9
b.	Conduct classes and field experiences for subordinates.	2.9
c.	Supervise on-job training.	2.8
d.	Recommend changes in training program.	2.8
e.	Evaluate training programs.	2.7
10.	Maintain a district office.	3.5
a.	Communicate with supervisor and clientele.	3.6
b.	Keep complete files on all reports.	3.5
c.	Maintain records on all field surveys.	3.3
11.	Obtain leases with land owners for land open to public activities.	2.5
a.	Maintain farm-game safety zone programs.	2.6
b.	Distribute game commission signs and posters for farmers.	2.6
c.	Advise land owners or operators on planting and maintaining game habitats.	2.4
12.	Conduct a wildlife control program.	2.1
a.	Trap or dispose predatory animals.	2.1
b.	Trap or move excess game animals to areas where animals are deficient.	2.1
13.	Supervise the wildlife permit system.	1.8
a.	Issue permits for taxidermists, fur buyers, propagators.	2.0
b.	Inspect and issue permits for regulated shooting grounds.	1.9
c.	Issue permits for game land timber sales.	1.4

GAME FARMER

Other Titles: Game Bird Raiser, Game Farm Manager, Wildlife Specialist, Game Propagator, Commercial Game Breeder, Superintendent Game Farmer, Breeder, Shooting Reserve Operator.

Job Description:

Operates a game farm for the selection, propagation, care and feeding, distribution and/or sale of game animals. The typical work includes selecting and marking of foundation stock, operation of incubators, hatchers, brooders, and the operation and maintenance of variety of farm tools and equipment. Feeds and waters birds and cleans their pen and yards. Examines birds to detect signs of illness and innoculates ill birds with antibiotics. Operates and provides preventative maintenance of field tillage, planting, and harvesting equipment. Clips birds wings to keep them in captivity. Trims bills of birds to prevent pecking. Exhibits prize birds at shows. Maintains game range, game farm buildings, and their installed equipment. Mixes feed according to formulas and fills feeding stations. Sets and maintains traps for predatory and noxious animals and birds that may prey upon and carry diseases to charges. Keeps farm records and makes reports. Supervises temporary employees assigned. Patrols the game farm or game refuge area to enforce game laws. Liberates birds and animals in designated areas.

Competencies Identified and Validated

N = 30*

Competencies	Weighted Mean**
1. Identify breeds of game birds.	2.8
a. Identify breeds of pheasants.	3.2
b. Identify other breeds of game animals.	2.8
c. Identify breeds of turkeys.	2.6
2. Select breeding stock.	3.4
a. Select individual animals on the basis of size, color, vigor, or other desired characteristics.	3.7
b. Select breeds that are adaptable to that area.	3.1

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* Responses from 30 Game Farmers in 12 states. Survey conducted by Department of Agricultural Education, The Pennsylvania State University, University Park, Pennsylvania 16802.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

3.	Select equipment.		3.4
	a.	Select incubators that are adaptable for the species.	3.4
	b.	Select hatchers that are suitable for the species.	3.4
	c.	Select brooders that are suitable for the species.	3.4
4.	Prepare equipment for the incubation of eggs.		3.9
	a.	Sanitize equipment.	3.9
	b.	Adjust equipment to optimum moisture and temperature conditions.	3.8
5.	Collect eggs.		3.6
	a.	Collect eggs at frequent intervals.	3.7
	b.	Collect crack free eggs.	3.5
6.	Incubate eggs.		3.6
	a.	Maintain optimum temperature and moisture conditions.	3.8
	b.	Select eggs that are free from damage.	3.6
	c.	Select fertile eggs of normal size and shape.	3.5
7.	Hatch eggs.		3.6
	a.	Maintain optimum temperature and moisture conditions.	3.9
	b.	Place eggs in hatchers at the proper time.	3.8
	c.	Turn eggs at specific intervals.	3.2
8.	Brood chicks.		3.7
	a.	Place chicks in the brooder area at proper time.	3.8
	b.	Maintain feed and water.	3.8
	c.	Maintain optimum temperature and moisture conditions.	3.6
9.	Raise birds.		3.3
	a.	Maintain adequate water supply.	3.7
	b.	Maintain proper feed ration for optimum growing conditions.	3.6
	c.	Maintain optimum temperature and moisture conditions.	3.2
	d.	Trim bills to prevent pecking.	3.2
	e.	Clip wings to prevent flight from captivity.	3.1

10. Identify disease symptoms.	3.4
a. Recognize clinical diseases.	3.5
b. Recognize sub-clinical diseases.	3.3
11. Treat diseases when observed in flock.	3.6
a. Administer antibiotics.	3.8
b. Isolate diseased birds if possible.	3.4
12. Prepare feed ration with percentages of nutrients for optimum growth.	2.5
a. Store ration.	2.9
b. Calculate percentages of nutrients in feed ration.	2.8
c. Grind and mix ration.	2.0
13. Control waste of feeds.	3.2
a. Provide an adequate number of feeders for number of birds.	3.6
b. Provide approved feeders.	3.3
c. Fill feeders to two-thirds full.	2.8
14. Control predatory animals.	3.3
a. Trap or dispose of predatory animals.	3.3
b. Build fences or other screening devices.	3.2
15. Prepare birds for sale or distribution.	3.4
a. Catch birds.	3.5
b. Confine birds.	3.4
c. Inspect birds.	3.4
16. Dispose of animals through sale or distribution.	2.5
a. Arrange terms of sale.	2.7
b. Transport animals to buyers.	2.3
17. Keep farm records and accounts.	3.0
a. Maintain farm records that reflect the financial status of the farm operation.	3.2
b. Maintain financial records that reflect actual cost of producing each flock.	3.0
c. Maintain feed records on each group of birds that list the amount of feed utilized per bird.	2.8
18. Evaluate production procedures.	3.0
a. Calculate the percentage of livability.	3.2
b. Determine the overall cost per bird for the farm operation.	3.1
c. Determine the profit or loss for the farm operation.	3.1

	d.	Calculate the feed conversion factors.	2.8
	e.	Determine the cost of feed per bird for each group.	2.6
19.		Operate game farm and wildlife equipment.	3.0
	a.	Service machinery and equipment according to operator's manual.	3.3
	b.	Use safety standards relating to operation of a particular piece of machinery.	3.3
	c.	Recognize malfunctions of equipment.	3.3
	d.	Adjust equipment under field conditions for maximum efficiency.	3.1
	e.	Become familiar with operator's manual for each piece of equipment.	3.0
	f.	Operate machinery and equipment under a variety of field conditions.	3.0
	g.	Attach accessory equipment to basic farm power unit.	2.9
	h.	Prepare machines and equipment for storage.	2.9
	i.	Maintain records of maintenance and repair on machinery and equipment.	2.8
	j.	Maintain a daily log of number of hours each piece of equipment is used.	2.4
20.		Provide preventative maintenance for farm equipment including trucks.	3.1
	a.	Lubricate equipment.	3.3
	b.	Replace worn parts.	3.3
	c.	Sharpen equipment.	3.2
	d.	Adjust equipment.	3.2
	e.	Clean equipment.	3.1
	f.	Perform noncritical welding.	2.7
21.		Provide maintenance for farm buildings by performing subjourneyman tasks in:	2.8
	a.	Carpentry.	2.9
	b.	Plumbing.	2.8
	c.	Painting.	2.8
	d.	Electricity.	2.8
22.		Assist in the enforcement of game laws during peak periods of hunter activity.	2.7
	a.	Explain local hunting restrictions.	2.8
	b.	Refer game law violations to supervisors.	2.7
	c.	Patrol assigned area.	2.5
23.		Supervise temporary employees assigned to the farm.	3.2
	a.	Interpret directions.	3.4
	b.	Train new personnel.	3.2
	c.	Plan and administer work schedules.	3.1

WILDLIFE TECHNICIAN

Other Titles: Game Technical Aide, Natural Resources Technician - Wildlife, Wildlife Biologist, Game Biologist.

Job Description:

Assists in a variety of management activities and performs technical field work in game and wildlife habitat investigations, and studies; surveys, artificial and natural game propagation and rearing, wildlife habitat improvement, population, and wild animal damage control, game population census, census of hunting and trapping harvest; aids construction, maintenance, and repair of buildings, facilities used in breeding, hatching, feeding, and treating diseases of artificially raised game birds. Traps, cares for, transports and displays wild game animals and birds. Captures and prepares samples of water, food, and soils for chemical analysis. Conducts analytical tests to determine nutrient value and the presence of extraneous pesticide chemicals in wildlife species. Uses special equipment to follow movements of individual animals. Summarizes data and writes technical reports. Assists in the location, development and operation of controlled hunting areas. Assists with game conservation education in area assigned. Supervises nonprofessional and temporary field personnel. Aids in the location and the establishment of boundary markers for state game lands and game preserves. Assists in the enforcement of game laws during peak periods of sports activity. Usually employed by a governmental agency.

Competencies Identified and Validated

N = 30*

Competencies	Weighted Mean**
1. Supervise operation of equipment and facilities for plant life projects as assigned.	2.7
a. Make recommendations for food, cover, planting, etc.	3.7
b. Provide technical assistance in tree and shrub planting.	3.0
c. Interpret and apply directions and/or specifications.	2.8
d. Supervise preparation of seed beds.	2.1

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* Responses from 30 Wildlife Technicians in 11 states. Survey conducted by Department of Agricultural Education, The Pennsylvania State University, University Park, Pennsylvania 16802.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

2.	Collect and record information on wildlife in a specific area.	3.4
a.	Inventory species of wildlife in specific area.	3.7
b.	Take census of wildlife killed in specific areas.	3.7
c.	Inventory available feed for wildlife.	3.5
d.	Determine the balance of animals to food supply.	3.4
e.	Evaluate wildlife habitat.	3.2
f.	Determine physical condition of wildlife.	3.0
3.	Capture and mark wild animals.	3.0
a.	Trap or immobilize wild animals.	3.2
b.	Mark wild animals using coloring, marking, or tagging techniques.	3.2
c.	Use radio tracking devices.	2.7
4.	Aid in the construction, maintenance, and repair of buildings.	1.8
a.	Perform sub-journeyman skills in carpentry.	1.9
b.	Perform sub-journeyman skills in electricity.	1.7
c.	Perform sub-journeyman skills in plumbing.	1.7
5.	Gather samples of water, food, and soil.	2.2
a.	Gather representative samples.	2.3
b.	Prevent contamination of samples.	2.3
c.	Select possible areas to sample.	2.2
6.	Conduct simple analytical tests.	1.5
a.	Analyze water samples for pH and pesticide residues.	1.7
b.	Analyze soil samples for pH and pesticide residues.	1.4
c.	Analyze food samples for pesticide residues.	1.3
7.	Transport game animals.	3.0
a.	Hold the required license for operating equipment.	3.0
b.	Use appropriate restraining methods to prevent injury to animals.	3.0
8.	Use radio tracking methods.	2.6
a.	Fit equipment to animals.	2.9
b.	Trace animal range area.	2.9
c.	Record, read, and interpret data.	2.8
d.	Determine appropriate equipment to be used.	2.0
9.	Operate equipment.	2.9
a.	Operate and maintain equipment safely.	3.4
b.	Perform preventative maintenance.	3.0

	c.	Maintain daily log of number of hours of operation.	3.0
	d.	Adjust implements for maximum efficiency and safety.	2.9
	e.	Perform necessary field repairs.	2.7
	f.	Obtain necessary licenses.	2.6
10.		Assist in the development and operation of controlled wildlife areas.	2.7
	a.	Identify wildlife species, wildlife food, and cover crops.	3.1
	b.	Inventory animal population.	3.0
	c.	Conduct public relations functions with users.	3.0
	d.	Keep records on daily kill and census.	2.8
	e.	Project the number of licenses to be issued in accordance with maintaining wildlife balance.	2.0
	f.	Identify disease symptoms and administers antibiotics.	1.7
11.		Assist professional personnel with wildlife education.	2.4
	a.	Explain wildlife objectives to individuals and groups.	2.9
	b.	Prepare literature for the public.	2.1
	c.	Prepare in-service material for wildlife non-professional personnel.	2.1
12.		Supervise non-professional and temporary field personnel.	2.8
	a.	Interpret directions.	2.9
	b.	Plan and administer work schedules.	2.8
	c.	Train new personnel.	2.8
13.		Locate and establish boundaries for game land and game preserves.	2.3
	a.	Plot data on existing maps.	2.4
	b.	Interpret and use aerial photographs, topographic maps to aid in identifying areas and boundaries.	2.3
	c.	Make maps.	2.1
14.		Assist in the enforcement of game laws during peak periods of hunter activity.	2.5
	a.	Explain local hunting restrictions.	2.8
	b.	Refer game law violations observed to supervisors.	2.7
	c.	Patrol assigned area.	1.7

FORESTRY

In many parts of the United States climatic conditions are ideal for growing forest trees. Thousands of persons are employed in harvesting and processing trees into lumber and other essential products. The occupations surveyed in Forestry in this study follow.

Occupation Cluster/Occupations		Page
Forest Production, Logging, Harvesting	Forestry Aide	540
	Logging Skidder Operator	546
	Wood Producer	550
Primary Wood Processing	Sawyer	556
	Sawmill Worker	559
Forest Protection	Forest Fire Ranger	565
	Forest Fire Fighter	568
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Special Products	Christmas Tree Farmer	578
	Maple Syrup Producer	582

FORESTRY AIDE

Other Titles: Timber Cruiser, Tree Planter, Compassman, Timber Marker.

Job Description:

The Forestry Aide is a trained person who assists professional foresters in planning and executing forestry projects on public and private lands. Unlike the forest technician, however, the aide usually is not as highly trained in forestry practices. Duties and responsibilities of a forestry aide may increase, however, over a period of several years until the aide may be performing many of the duties of a professional forester. Most forestry aides perform the following duties: assisting foresters in managing timber stands, assisting foresters in conducting land surveys, performing conservation and reforestation duties, preventing and controlling forest fires, and operating and maintaining equipment.

Competencies Identified and Validated

N = 51*

Competencies	Weighted Mean**
1. Assist forester in managing forest properties.	2.4
a. Measure distance between sample plots.	3.4
b. Record number of trees by species.	3.3
c. Assist forester in marking timber to be removed for thinning.	3.2
d. Use compass to direct cruising operations.	3.2
e. Assist controlled burning operations.	3.0
f. Measure tree height using Abney level.	3.0
g. Measure tree diameter at breast height (DBH) using diameter tape.	2.9
h. Mark insect and disease damaged trees for salvage.	2.9
i. Recognize insect and disease damage.	2.9
j. Mark undesirable trees to be cut and harvested.	2.8
k. Measure growth rate using increment borer.	2.6
l. Measure DBH using cruiser's stick.	2.6
m. Measure basal area using wedge prism.	2.5
n. Remove undesirable trees by use of herbicide injectors.	2.5

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* Responses from 51 Forestry Personnel in 5 states. Study conducted by Department of Agricultural and Extension Education, Mississippi State University, Mississippi State, Mississippi 39762.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

o.	Lay out sample plots.	2.4
p.	Calculate volume of sawlogs using Doyle scale.	2.4
q.	Record volume of individual trees using tally sheet method.	2.4
r.	Act as flagman for aerial spraying.	2.3
s.	Measure tree height using cruisers stick.	2.3
t.	Calculate volume of pulpwood.	2.2
u.	Remove undesirable trees by girdling.	2.2
v.	Use ground equipment to spray for insect control.	2.2
w.	Interpret aerial photographs to identify forest cover types, classes, and areas.	2.1
x.	Assist in building and repairing bridges.	2.0
y.	Maintain drainage systems (culverts, ditches, etc.).	2.0
z.	Install culverts and drains.	2.0
aa.	Calculate volume of sawlogs using Scribner scale.	1.7
bb.	Establish logging roads using bulldozer, motorgrader, etc.	1.7
cc.	Calculate volume of sawlogs using International scale.	1.6
dd.	Grade and level existing logging roads.	1.5
ee.	Prune trees to improve timber stand.	.8
2.	Assist in conducting surveys and measuring and marking boundaries.	2.3
a.	Mark boundaries and corners using paint.	3.9
b.	Make linear measurements by using surveyor's chain.	3.0
c.	Make linear measurements by pacing.	2.9
d.	Mark boundaries and corners by using tree blazes.	2.8
e.	Use compass to maintain direction of survey.	2.7
f.	Clear brush for surveying team.	2.5
g.	Transport instrument for surveyors.	2.0
h.	Carry and hold surveyor's rod.	1.8
i.	Use surveying instrument to determine boundaries.	1.6
j.	Set up instrument for surveyor.	1.5
k.	Use surveying instrument to determine elevation.	1.2
l.	Calculate area measured.	1.1
3.	Perform conservation and reforestation duties.	2.6
a.	Keep records of trees planted, area covered, time spent.	3.2
b.	Direct planting crew.	3.1
c.	Plant trees using mechanical planter.	3.1
d.	Transport and care for seedling from nursery to planting site.	3.1

e.	Plant tree seedlings using hand tools (planting bar, tree planting hoe, mattock, etc.).	3.0
f.	Prepare planting site by use of herbicides.	2.3
g.	Assist aerial direct-seeding operations by serving as flagman.	2.2
h.	Plant trees by direct seeding using ground equipment.	2.2
i.	Collect cones and/or seeds from trees.	2.1
j.	Prepare planting site by plowing or disking.	2.1
4.	Prevent and control forest fires.	2.6
a.	Use maps to locate access roads and trails.	3.1
b.	Backfire to consume material.	3.0
c.	Extinguish remaining fire spots after main fire is under control (mop-up operations).	2.9
d.	Transport men and equipment to fire.	2.8
e.	Establish fireline with tractor and plow.	2.8
f.	Use swatter, rakes, and/or shovel to fight fire directly.	2.7
g.	Establish fireline using hand tools.	2.6
h.	Record fire crew time.	2.6
i.	Use maps to locate fires and report position.	2.6
j.	Repair and service equipment after the fire.	2.5
k.	Submit fire reports.	2.3
l.	Use backpack pump to fight fire directly.	2.3
m.	Coordinate fire fight from aircraft.	1.4
5.	Help enforce rules and regulations.	1.8
a.	Enforce safety rules and regulations.	2.8
b.	Enforce trespassing regulations.	2.2
c.	Enforce public institution regulations.	1.7
d.	Enforce traffic rules and regulations.	1.4
e.	Enforce camping and hiking regulations.	1.4
f.	Enforce game and fish regulations.	1.3
6.	Operate and maintain tools and equipment.	2.3
a.	Operate trucks. (1) Transport equipment and materials. (2) Haul crew members to work locations.	3.1
b.	Maintain trucks and cars. (1) Maintain engine oil level, coolant level on a daily basis. (2) Maintain tire air pressure. (3) Maintain battery electrolyte level, battery terminals, and cables. (4) Clean exterior of vehicle and cab. (5) Service or replace air cleaner.	2.5

(6) Change engine oil and oil filter using proper oil and replacement filter at periodic intervals.
(7) Clean and adjust spark plugs.
(8) Replace spark plugs.
(9) Replace ignition points.
(10) File and regap ignition points.

c. Operate bulldozer or other tractor. 2.4
(1) Attach implements to crawler or tractor.
(2) Plow firelanes.
(3) Load and secure on truck for transport.
(4) Pull mechanical tree planter.
(5) Plow with disk for site preparation for planting.
(6) Clear brush and shrubs from planting area.
(7) Grade and level roads.

d. Maintain fire fighting equipment. 2.4
(1) Clean fireplow and protect against rust.
(2) Replace fireplow points.
(3) Replace pump gaskets or washers.
(4) Lubricate backpack pump.
(5) Repair swatters.
(6) Clean firehose, shovels, and rakes.
(7) Clean backpack pump externally and internally.

e. Operate chain saw. 2.2
(1) Mix fuel and oil in proper proportion.
(2) Fell trees.
(3) Clear underbrush.
(4) Buck trees.
(5) Limb trees.

f. Maintain crawler or other tractor. 2.1
(1) Maintain engine oil level, radiator level, fuel level, hydraulic oil level, and transmission oil level on a daily basis.
(2) Maintain battery electrolyte level, battery terminals, and clamps as needed.
(3) Fill cooling system with antifreeze to maintain recommended freezing point.
(4) Maintain brake fluid level.
(5) Service or replace air cleaner on periodic basis.
(6) Adjust track tension (if applicable).
(7) Change engine oil and oil filters using proper oil and replacement filter at recommended intervals.
(8) Lubricate all grease fittings using proper grease at periodic intervals.

(9) Maintain fan belt tension.
(10) Replace ruptured external hydraulic lines.
(11) Change fuel filters at periodic intervals.
(12) Repair or replace cables and wire rope.
(13) Clean tractor with steam cleaner or water hose.
(14) Flush coolant system.
(15) Adjust clutch (if applicable).
(16) Adjust brakes.
(17) Remove air from diesel fuel lines.
(18) Perform minor welding repairs using electrical or oxygen acetylene welding equipment.
(19) Repaint tractor.
(20) Replace brake shoes or pads.
(21) Adjust diesel injectors.
(22) Time diesel injection.

g. Maintain chain saws. 1.8
(1) Sharpen chain.
(2) Clean and regap spark plug.
(3) Adjust chain for proper tension.
(4) Clean saw and prepare for storage.
(5) Replace chain sprocket as needed.
(6) Replace bows or bars.
(7) Replace broken chain links.
(8) Clean and service carburetor air cleaner.
(9) Replace chain clutch as needed.
(10) Replace ignition points.
(11) Adjust carburetor for maximum efficiency.

7. Develop positive attitudes toward work and fellow workers. 3.6

a. Remain safety conscious of other workers. 3.9
b. Cooperate with fellow employees. 3.8
c. Accept responsibility for own actions. 3.8
d. Listen carefully to daily work instructions. 3.8
e. Report to work on time and ready to work. 3.8
f. Accept responsibility for equipment used. 3.7
g. Use proper safety equipment and dress. 3.7
h. Show a positive, optimistic attitude toward work in general and fellow workers. 3.7
i. Demonstrate a willingness to learn new skills and to improve old skills. 3.7
j. Show mature judgement on the job. 3.6
k. Recognize own importance to the operation. 3.5
l. Show tact in dealing with others. 3.5
m. Show initiative in daily work. 3.5

n.	Demonstrate an ability to adjust to changes in general work routine.	3.4
o.	Accept criticism in a constructive manner.	3.4
p.	Know his own abilities and limitations.	3.2

LOGGING SKIDDER OPERATOR

Other Titles: Logging Tractor Operator.

Job Description:

Operates rubber tired or crawler tractor equipped with one or more accessories, such as bulldozer blade, grapple, logging arch, cable winches, hoisting rack, and crane boom, to skid, load, unload, or stack logs, pull stumps, or clear brush. May build or repair logging and skidding roads or trails. May use skidder to pull stalled trucks or other equipment to solid ground and push or plow firelanes. Attaches choking cables or chains to logs and skids to loader landing. Deposit logs in a manner to facilitate loading operations. Performs preventative and general maintenance on skidder.

Competencies Identified and Validated

N = 31*

Competencies		Weighted Mean**
1.	Operate skidder.	2.2
a.	Recognize malfunctions in skidder operation.	3.6
b.	Operate winch to skid logs, or pull stalled vehicles.	3.6
c.	Choose appropriate gear and speed for safe, efficient operation.	3.6
d.	Attach cable or chain chokers to logs.	3.5
e.	Pull stalled vehicles to solid ground.	3.4
f.	Establish skidding roads and trails.	3.3
g.	Establish landing area for logs.	3.2
h.	Load and secure skidder on trailer for transport.	3.1
i.	Match skidder capacity to number and weight of logs.	3.1
j.	Maintain skidding roads and trails.	2.4
k.	Establish ditches and drains for wet areas.	2.2
l.	Attach implements to skidder.	2.0
m.	Operate skidder on highway to transport.	2.0
n.	Use hydraulic grapple to skid logs.	1.7
o.	Adjust fairlead for various loads.	1.5
p.	Pile brush or tops for cleanup.	1.2
q.	Push firelanes.	0.7

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* Responses from 31 Logging Skidder Operators in 5 states. Survey conducted by Department of Agricultural and Extension Education, Mississippi State University, Mississippi State, Mississippi 39762.

** 4.0 = Essential; 3.0 = Important; 2.0 - Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

r.	Pull fire plow.	0.1
s.	Pull disk plow.	0.1
t.	Pull tree planter.	0.1
2.	Perform preventative maintenance.	3.0
a.	Perform bi-weekly maintenance (100 hours).	3.1
(1)	Change engine oil and filter.	
(2)	Replace fuel filters.	
(3)	Lubricate all grease fittings not previously listed.	
(4)	Maintain belt tension.	
(5)	Drain dirt and water from fuel tank.	
b.	Perform daily maintenance (10 hours).	3.3
(1)	Maintain engine oil level.	
(2)	Maintain hydraulic oil level.	
(3)	Inspect instruments for normal operation.	
(4)	Maintain coolant level.	
(5)	Fill fuel tank.	
(6)	Lubricate universal joints and drive shaft slip joints.	
(7)	Lubricate trunnion pins.	
(8)	Clean leaves, twigs, or branches from skidder.	
(9)	Inspect hydraulic system for visible leaks.	
(10)	Maintain tire air pressure.	
(11)	Maintain battery electrolyte level.	
(12)	Drain fuel filters.	
(13)	Inspect tires for cuts or scrapes.	
c.	Perform weekly maintenance (50 hours).	3.0
(1)	Maintain transmission fluid level.	
(2)	Maintain oil level in transmission differential.	
(3)	Maintain oil level in planetary drives.	
(4)	Maintain oil level in winch housing.	
(5)	Lubricate dozer blade trunnions.	
(6)	Maintain brake fluid level in master cylinder.	
(7)	Maintain oil level in PTO differential.	
(8)	Clean transmission breather.	
d.	Perform quarterly maintenance (600 hours).	2.5
(1)	Replace or clean air filter element.	
(2)	Clean radiator externally.	
(3)	Drain and refill hydraulic system, replacing filters.	

(4)	Change oil in winch housing.	
(5)	Drain and flush fuel tank.	
e.	Perform semi-annual maintenance (1,200 hours).	2.4
(1)	Clean entire machine using high pressure hose.	
(2)	Drain and refill transmission replacing filters.	
(3)	Clean machine using steam cleaner.	
(4)	Drain and flush cooling system.	
(5)	Drain and refill differentials and planetary hubs.	
3.	Perform general maintenance.	2.1
a.	Fill coolant system with anti-freeze coolant to maintain recommended freeze protection.	3.1
b.	Replace wire rope on winch.	3.0
c.	Replace ruptured external hydraulic lines.	3.0
d.	Read and follow directions in operator's manual.	2.9
e.	Select appropriate oils and greases.	2.8
f.	Replace broken or worn universal joints.	2.7
g.	Place battery on electrical charger.	2.7
h.	Repair ruptured external hydraulic lines.	2.7
i.	Replace coolant water hoses.	2.6
j.	Install new chokers.	2.6
k.	Replace generator or alternator as provided.	2.5
l.	Maintain records of maintenance.	2.4
m.	Use booster cables to start skidder.	2.4
n.	Bleed air from diesel fuel system.	2.4
o.	Clean battery cables and terminals.	2.3
p.	Remove tires for repair or replacement.	2.2
q.	Install ferrules on winch lines and chokers.	2.0
r.	Lubricate wire rope.	2.0
s.	Adjust clutches if applicable.	2.0
t.	Replace electrical starting motor.	1.9
u.	Adjust brakes.	1.9
v.	Adjust steering controls.	1.8
w.	Bleed air from hydraulic braking system.	1.8
x.	Replace exhaust system parts.	1.8
y.	Adjust power shift transmission if applicable.	1.3
z.	Adjust diesel injectors if applicable.	1.3
aa.	Replace brake shoes or pads.	1.3
bb.	Perform welding repairs using electric welder.	1.2
cc.	Splice wire rope.	1.2
dd.	Perform welding repairs using oxygen-acetylene torch.	1.0
ee.	Replace burned-out or broken light bulbs.	0.9

4.	Operate other machinery.	2.0
a.	Operate chain saw to limb trees.	2.4
b.	Operate chain saw to buck trees.	2.4
c.	Operate bulldozer to establish skidding. and logging roads and trails.	2.3
d.	Operate bulldozer to maintain skidding and logging roads and trails.	2.3
e.	Operate chain saw to fell trees.	2.3
f.	Operate truck to transport workers.	2.3
g.	Operate knuckle-boom loader.	2.1
h.	Operate truck to haul timber.	1.9
i.	Operate truck to haul skidder.	1.9
j.	Operate motor grader.	0.2
5.	Develop positive attitudes toward work and fellow workers.	3.3
a.	Remain safety conscious of other workers at all times.	3.7
b.	Recognize his own importance to the operation.	3.5
c.	Report to work on time and ready to work.	3.5
d.	Listen carefully to daily work instructions.	3.4
e.	Cooperate with fellow employees.	3.4
f.	Show mature judgment on the job.	3.4
g.	Use proper safety equipment and dress.	3.4
h.	Accept responsibility for equipment he uses.	3.4
i.	Accept responsibility for his own actions.	3.3
j.	Know his own abilities and limitations.	3.3
k.	Demonstrate a willingness to learn new skills and to improve old skills.	3.3
l.	Show tact in dealing with others.	3.2
m.	Demonstrate an ability to adjust to changes in general work routine.	3.1
n.	Show initiative in daily work.	3.1
o.	Accept criticism in a constructive manner.	3.0
p.	Show a positive optimistic attitude toward work in general and fellow workers.	2.6

WOOD PRODUCER

Other Titles: Logging Foreman, Logging Contractor.

Job Description:

The Wood Producer is the key person in timber procurement. The primary duty of the producer is to bring timber, men, and machinery together at the right time and in the right place. To accomplish this primary duty the wood producer must perform the following duties: procuring timber for harvesting, handling business aspects of logging, supervising workers, managing harvesting operations, and operating and maintaining equipment.

Competencies Identified and Validated

N = 32*

Competencies		Weighted Mean**
1.	Procure timber for harvesting.	2.1
a.	Locate public and private roads and trails to be used in hauling.	3.3
b.	Obtain right-of-way for crossing third-party property.	3.3
c.	Determine boundaries and corners by visual inspection.	3.2
d.	Execute contract with owner on basis of timber removed.	3.0
e.	Calculate volume of stand in terms of board feet and/or cords.	3.0
f.	Submit bids on timber offered for sale.	2.5
g.	Execute contract on basis of lump-sum payment.	2.5
h.	Evaluate cruiser's report.	2.4
i.	Select trees to be thinned for timber stand improvement.	2.4
j.	Determine boundaries and corners by surveying.	1.8
k.	Measure tree diameter using diameter tape.	1.5
l.	Measure tree diameter using cruiser's stick.	1.5
m.	Measure and mark sample plots for cruising.	1.4
n.	Interpret aerial photographs to identify cover types, forest classes, and areas.	1.4
o.	Measure tree height using cruiser's stick.	1.4

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* Responses from 32 Wood Producers in 5 states. Study conducted by Department of Agricultural and Extension Education, Mississippi State University, Mississippi State 39762.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

p.	Measure tree height using Abney level.	0.3
2.	Handle business aspects of logging.	2.9
a.	Maintain records of income.	3.5
b.	Maintain records of expenses.	3.2
c.	Maintain records of payments to timber owners.	3.2
d.	Maintain records of timber cut.	3.1
e.	Maintain adequate insurance for equipment and workers.	3.1
f.	Maintain records of workers' time and pay.	2.9
g.	Prepare tax reports.	2.8
h.	Maintain records of worker-related accidents.	2.8
i.	Maintain records of machinery maintenance.	2.6
j.	Maintain records of equipment depreciation.	2.5
k.	Use records for making decisions on equipment purchase, timber purchase, etc.	2.5
3.	Supervise worker.	2.7
a.	Train workers in using chain saw.	3.2
b.	Train workers in using skidder.	3.1
c.	Show mature judgement.	3.1
d.	Train workers in using trucks and trailers.	3.0
e.	Give instructions and explanations for days work.	3.0
f.	Terminate workers with unsatisfactory work performance.	3.0
g.	Organize crew for continuous work.	3.0
h.	Supervise maintenance of equipment.	2.9
i.	Train workers in using knuckle-boom loader.	2.9
j.	Show tact and patience in dealing with crew members.	2.8
k.	Remain with crew as much as possible.	2.8
l.	Set and enforce standards of behavior.	2.7
m.	Give criticism in a constructive manner.	2.7
n.	Provide safety equipment and training.	2.6
o.	Interview potential workers.	2.6
p.	Set a daily or weekly production goal.	2.5
q.	Hire new workers.	2.4
r.	Train workers in using "Big Stick" loader.	2.4
s.	Recruit potential workers.	2.3
t.	Encourage friendly competition.	2.3
u.	Work as a supervisor rather than a worker.	1.6
4.	Manage harvesting operations.	2.8
a.	Cut timber to mill specifications.	3.7
b.	Plan work with regard to weather conditions.	3.4
c.	Avoid damage to timber not marked for cutting.	3.3
d.	Build roads for efficient hauling.	3.1
e.	Maintain existing roads.	3.1

f.	Cut tract according to a systematic plan.	3.0
g.	Provide for extra equipment, tools, parts, and/or supplies for replacement or repair in the field.	3.0
h.	Establish a landing area for loading.	2.8
i.	Build bridges.	2.6
j.	Plan harvesting to give a minimum of disturbance of the local ecology.	2.4
k.	Install culverts.	2.2
l.	Install drainage ditches.	2.2
m.	Maintain drainage ditches.	1.8
5.	Operate equipment.	2.5
a.	Operate chain saw.	3.9
(1)	Mix fuel and oil in proper proportions.	
(2)	Maintain automatic-oiler oil level.	
(3)	Fell tree in a safe efficient manner.	
(4)	Oil chain using manual oiler.	
(5)	Plan escape routes before cutting.	
(6)	Observe position of crew members before felling.	
(7)	De-limb trees.	
(8)	Wear proper safety apparel (hard hat, gloves, goggles, leggings, etc.).	
(9)	Fell trees to facilitate loading or skidding.	
(10)	Buck trees into standard lengths.	
(11)	Clear cutting area of underbrush before cutting.	
(12)	Mark trees for bucking.	
b.	Operate skidder.	2.8
(1)	Deposit logs in a pile which will facilitate loading.	
(2)	Operate winch to skid logs.	
(3)	Recognize malfunctions in skidder operations.	
(4)	Match skidder capacity to number and weight of logs.	
(5)	Choose appropriate gear and speed for safe, efficient operation.	
(6)	Choke logs with cable or chain.	
(7)	Attach implements to skidder.	
c.	Operate "Big Stick" loader.	1.7
(1)	Operate winch.	
(2)	Balance and stack logs or bolts.	

d. Operate knuckle-boom loader. 2.5

(1) Stack and balance load.
(2) Load logs onto truck.
(3) Transport loader to landing and set-up for loading.

e. Operate trucks. 2.6

(1) Bind load with chains or cable.
(2) Transport to mill or woodyard.
(3) Keep records of amount of wood delivered.
(4) Supervise loading.
(5) Attach trailers or semi-trailers.

f. Operate other equipment. 1.1

(1) Electric welder.
(2) Oxygen-acetylene torch.
(3) Battery charger.
(4) Air compressor.
(5) Steam cleaner.
(6) High pressure washer.

6. Maintain equipment. 2.3

a. Maintain chain saws. 2.6

(1) Sharpen blade using file and guide.
(2) Adjust chain tension.
(3) Repair chain links.
(4) Recognize malfunctions in blade cutting action.
(5) Replace chain, sprocket, clutch, and bars or bows as needed.
(6) Clean and service air cleaner.
(7) Clean saw of dust, dirt, or grease at periodic intervals.
(8) Rotate cutter bar for uniform wear.
(9) Clean and/or replace fuel strainer.
(10) Adjust idle speed carburetor screw.
(11) Adjust high speed carburetor screw.
(12) Replace or repair rewind starters.
(13) Clean and gap spark plug.
(14) Check and tighten fasteners daily.
(15) Install ignition breaker points.
(16) Replace carburetor reeds and/or gaskets.
(17) Flush fuel tank periodically.
(18) Prepare saw for storage.
(19) Replace piston rings.
(20) Sharpen blade using mechanical sharpener.

b. Maintain skidder. 2.5

- (1) Lubricate all grease fittings at proper intervals using appropriate lubricant.
- (2) Maintain engine oil level, coolant level, transmission oil level, hydraulic oil level, and fuel level on a daily basis.
- (3) Change engine oil and filters, and transmission oil and filters, and hydraulic oil and filters on a periodic basis using proper oils and replacement filters.
- (4) Maintain fan belt tension.
- (5) Adjust brakes.
- (6) Clean battery cables and terminals.
- (7) Adjust clutch as applicable.
- (8) Drain water and dirt from fuel tank and filters.
- (9) Adjust steering controls.
- (10) Adjust diesel injectors.
- (11) Time diesel injections.

c. Maintain knuckle-boom loader. 2.4

- (1) Maintain power unit oil level, coolant level, and battery electrolyte level.
- (2) Maintain hydraulic oil level.
- (3) Lubricate all grease fittings using proper lubricant.
- (4) Clean hydraulic oil breather.
- (5) Change hydraulic oil and filter using proper oil and replacement filters.
- (6) Replace ruptured hydraulic lines.
- (7) Clean loader of dirt, leaves, dust, etc.
- (8) Repair leaking hydraulic cylinders.
- (9) Replace leaking seals.

d. Maintain trucks. 2.4

- (1) Maintain engine oil, battery, and fuel levels on a daily basis.
- (2) Change engine oil and filter.
- (3) Maintain tire air pressure and checks for cuts and scrapes.
- (4) Lubricate chassis and drive shaft(s).
- (5) Maintain battery terminals and clamps.
- (6) Maintain brake fluid level.
- (7) Service or replace air cleaner.
- (8) Adjust brakes.
- (9) Replace spark plugs (if applicable).

(10) Maintain fan belt tension.
(11) Adjust clutch if provided.
(12) Adjust carburetor (if applicable).
(13) Replace brake shoes or pads.
(14) Replace ignition points (if applicable).
(15) Replace exhaust system.
(16) Replace clutch if provided.
(17) Replace wheel bearings.
(18) Wash truck.
(19) Clean engine using steam cleaner.
(20) Repair frame using electric arc or acetylene welder.

e. Maintain wire rope. 1.4

(1) Install wire rope on winch.
(2) Lubricate wire rope.
(3) Cut wire rope using cutting torch.
(4) Cut wire rope using abrasive cutter.
(5) Install ferrules.
(6) Cut wire rope using shears.

SAWYER

Job Description:

The occupation may consist of setting up and operating power-driven circular and abrasive saws and band saws to cut lumber to specific dimensions; installing blades in saws and setting guide bars and stops; positioning material on saw table; starting saws and feeding material to blade; verifying dimensions of pieces using micrometer, gauges and rule; examining pieces for defects such as chipped edges or marred surfaces, and sorting defective pieces according to defect.

Competencies Identified and Validated

N = 34*

Competencies	Weighted Mean**
1. Perform general operation activities.	3.0
a. Check sources of power for operation.	3.3
b. Maintain proper working condition of machinery.	3.3
c. Maintain proper working condition of power system.	2.9
d. Have knowledge of the function of all mobile equipment.	2.8
e. Know the location of all fire extinguishers.	2.9
f. Know the location of all fire hoses.	3.0
g. Check fire extinguishers and determine workability.	2.6
h. Be sure that the work area is left in safe condition and properly secured.	3.1
2. Practice first aid and safety.	3.1
a. Know how and when to protect eyes and ears.	3.5
b. Know how to handle various materials.	2.9
c. Know the type of dress that is suitable for each operation.	2.9
d. Clear area of dangerous materials.	3.0
e. Know safety equipment that should be worn at all times in all areas.	3.1
f. Know who to notify in case of an accident.	3.4
g. Have knowledge of first aid and how to apply it.	2.7

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* Responses from 34 Sawmill Workers and/or their Work Supervisors in 17 states. Survey conducted by Department of Agricultural Education, Alcorn State University, Lorman, Mississippi 39096.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

	h.	Know signals to give when workers are to vacate an area.	3.0
3.	Operate carriage.		2.9
	a.	Have knowledge of distance and space.	3.2
	b.	Be able to ride short distances backwards and forward when necessary.	1.8
	c.	Check rollers and coasters.	2.8
	d.	Check bearings and fittings.	3.1
	e.	Check feeding system.	3.2
	f.	Make safety check of work area.	3.2
4.	Operate circular saw.		3.1
	a.	Check teeth for sharpness.	3.4
	b.	Check work area for safety.	3.4
	c.	Check teeth for damage.	3.5
	d.	Have knowledge of pulley operation.	2.8
	e.	Check belts for operation.	3.1
	f.	Check the electrical system.	2.7
	g.	Maintain a constant flow of logs going through the saw.	3.4
	h.	Have knowledge of feeding logs into saw.	3.8
	i.	Check all work area for foreign material.	3.2
	j.	Determine the necessary time to change saw blade.	3.2
	k.	Sharpen saw teeth.	2.3
	l.	Adjust saw for adequate operation.	2.9
5.	Operate log conveyer.		2.3
	a.	Check all points for lubrication.	2.1
	b.	Make complete safety check.	2.9
	c.	Know pulley sizes.	2.0
	d.	Know pulley ratios.	1.9
	e.	Know belt sizes and materials.	2.0
	f.	Have knowledge of conveyer function and limitations.	2.9
	g.	Have knowledge of drive chain sizes and function.	2.0
	h.	Have knowledge of driven chain size and function.	2.4
6.	Determine grade and quality of lumber.		3.5
	a.	Understand the transformation of logs to lumber.	3.8
	b.	Know the types of logs.	3.7
	c.	Know the types of lumber.	3.7
	d.	Understand various cuts of lumber.	3.7
	e.	Understand lumber size.	3.7
	f.	Know how to calculate board feet.	3.3
	g.	Understand regular and special length lumber.	3.5
	h.	Know grades of lumber.	3.5
	i.	Know condition of lumber.	3.1

7.	Operate quad saw.	2.7
a.	Make sure DSI auto sealer is on and functioning.	2.7
b.	Check all working area for foreign materials.	2.7
c.	Examine log deck for proper number of logs.	2.5
d.	Check all saws for proper function and sharpness.	2.7
e.	Check parts for proper oil level.	2.7
f.	Start infeed chain.	2.9
g.	Start cutoff saws and chain bed.	2.8
h.	Keep a constant flow of logs into cutoff saw.	2.7
i.	Feed logs one at a time.	2.7
j.	Remove all portions not suitable for quad saw.	2.7

Job Description:

The occupation of Sawmill Worker consists of the following duties in preparing logs for cutting into lumber and storing cut lumber in sawmill: unload logs from trucks and/or cars; roll logs onto sawmill deck; examine logs for defects such as imbedded pieces of iron or stone, decayed wood and splits, and mark defects for removal; roll logs from deck onto log carriage; adjust position of log on carriage to cut lumber of required thickness and width; sort and guide planks from saw onto roller tables and/or conveyors and trim edges; straighten lumber on conveyors and operate sawing machine to straighten edges of rough lumber. May sharpen and adjust teeth of saws, and may tend fires in donkey engine.

Competencies Identified and Validated

N = 34*

Competencies	Weighted Mean**
1. Practice first aid and safety.	3.3
a. Know how and when to protect eyes and ears.	3.6
b. Have knowledge of how to handle various materials.	3.3
c. Have knowledge of the type of dress suitable for each operation.	3.9
d. Clear area of dangerous materials.	3.2
e. Have knowledge of the protective equipment that should be worn at all times in all areas.	3.2
f. Know who to notify in case of an accident.	3.6
g. Know basic information concerning first aid and how to apply it.	3.1
h. Know signals to give when workers are to vacate an area.	3.0
2. Operate debarker.	3.2
a. Check debarker knives for sharpness.	3.3
b. Examine debarker for damage.	3.4
c. Check solenoid on chain oiler to make sure it is working properly and set flow according to procedure in manual under lubrication.	2.8

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** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

d.	Check oil level in gear case.	3.2
e.	Check minimum shutdown pressure switches located on either side of debarker to make sure they are in working order.	3.1
f.	Check electrical interlock; this insures the feed works will not operate without the rotor already in operation.	2.7
g.	Add air pressure to bath infeed and outfeed systems and also rotor.	2.9
h.	Properly lubricate the equipment.	3.1
i.	Select the proper feed rate, rotor and feed mechanism air pressure.	3.1
j.	Maintain a constant flow of logs going through the debarker.	3.6
k.	Feed logs one at a time into debarker.	3.5
l.	Make sure logs are clear of rotor before stopping debarker.	3.4
3.	Operate cut-off saw.	3.3
a.	Check all working areas for foreign materials.	3.4
b.	Examine log deck for proper number of logs.	2.8
c.	Check all saws for proper function and sharpness.	3.4
d.	Check parts for proper oil levels.	3.4
e.	Start infeed chain.	3.5
f.	Start cutoff saws and chain bed.	3.5
g.	Keep a constant flow of logs into cut-off saw.	3.5
h.	Feed logs one at a time.	3.5
i.	Remove all portions not suitable for quad saw.	3.0
4.	Operate truck scales.	3.3
a.	Clear concrete weighing slab of obstructions.	3.3
b.	Turn on weighing scale.	3.4
c.	Test stamper to see if it is working.	3.2
d.	Check pit for water accumulation and pump out with sump pump.	3.2
e.	Weigh trucks coming in and make a heavy weight ticket.	3.4
f.	Weigh trucks leaving and make a heavy weight ticket.	3.3
5.	Operate bush log crane.	2.9
a.	Check oil and equipment.	2.8
b.	Check hydraulic arms for proper function.	3.0
c.	Stack logs on the log yard.	3.0
d.	Maintain an even flow of logs to the infeed chain.	3.0
e.	Store excess logs on the hold decks.	2.8

6. Operate stacker - mobile equipment.	3.2
a. Check brakes, tires and oil.	3.6
b. Check hydraulic arms for proper function.	3.5
c. Straighten up logs on the log yard.	3.3
d. Help log crane hoist maintain an even flow of logs to the infeed chain.	3.2
e. Store excess logs on the hold decks.	3.0
f. Attach and operate the bucket scoop to clean the log yard.	2.9
g. Attach scoop to loading forks.	2.7
7. Operate separator.	3.0
a. See that rolls in drop area are running.	3.4
b. Straighten lumber in drops if needed.	3.1
c. Straighten lumber by use of the lift stops.	2.9
d. Unplug all plug ups that occur in the separator work area.	3.1
e. Operate the pedals which operate the following:	
(1) Edge drop--boards to be edged.	3.2
(2) Chipper drop--slabs that will not make lumber.	3.1
(3) Resaw drop--slabs that will produce usable lumber.	3.0
f. Assist the lumber straightener as needed.	2.9
g. Replace chains when they come off.	2.7
h. Assist in changing saws at quad mill.	2.3
i. Keep work area clean.	2.9
8. Operate edger.	3.5
a. Check saws to make sure the edger is clear.	3.6
b. Check light lines for proper operation.	3.5
c. Start the edger.	3.6
d. Select boards to be edged and lift bumper so the sweep chains will transfer them from the bandmill outfeed rolls to the edge.	3.5
e. Edge all boards with full wane, bark, or any boards which do not have two even parallel sides; however, if there's a slab which will not make lumber, let it pass by on the outfeed rolls from the bandmill to the slab tripper where it will be diverted to the chipper.	3.6
f. Space boards so they will not overlap at outfeed of edger.	3.4
9. Operate resaw.	3.0
a. Fill oil cup for the saws.	3.0
b. Check blade to see if it is cracked or broken.	3.3

c.	Set up the machine.	3.0
	(1) Adjust clamp feed rolls.	2.9
	(2) Run a piece of lumber, measure and adjust accordingly.	3.2
d.	Keep a constant flow of lumber going through the machine.	3.2
e.	Continually observe the saw to see that it is not snaking or running off center; adjust it if necessary.	3.2
f.	Measure lumber periodically to see if the machine is still set correctly.	2.8
g.	Grease all fittings on the resaw once a week.	2.8
h.	Blow down the machine periodically during the shift.	2.9
i.	Change saw as required.	2.6
j.	Change saw guides as necessary.	3.5
10.	Operate trimmer-mill.	3.2
a.	Check for lock out tags.	3.4
b.	Make sure trimmer or drop area is clear of personnel.	3.6
c.	Inspect chains and lugs or feed table for broken chains, lugs or sprockets.	3.3
d.	Check saws for sharpness, securely fastened and see that all of them drop properly.	3.2
e.	Change saws weekly as needed.	2.8
f.	Grease fitting on trim saws once a week.	2.8
g.	Make checks of set works, scrap conveyor, all chains, and bumper shears.	2.8
h.	Cut up trims of slabs that won't make number 3 and better lumber.	3.3
i.	Feed only one piece of lumber for each row of lugs.	3.3
j.	Watch for plug ups where the wood drops onto the transfer belt.	3.4
11.	Operate sorter tender.	3.1
a.	Check for look out tags.	2.9
b.	Observe equipment for possible machine defects.	3.1
c.	Remove debris that may cause machine malfunctions.	3.2
d.	Start chain, automatic sort system and automatic lumber tally and make sure all counters are on zero.	3.3
e.	Check all rolls and chains for correct operation.	3.2
f.	Watch for excessive recirculation.	3.0
g.	Make sure no jams occur.	3.0
h.	Maintain a constant even flow of material.	3.2
i.	Feed one piece at a time.	3.2

12.	Operate stacker.	3.4
a.	Start stacker and test run empty to check for proper operation.	3.6
b.	Keep a constant flow of logs going onto the stacker arms for stacking.	3.0
c.	Straighten all lumber on the chains.	3.5
d.	Throw out all broken pieces.	3.2
e.	Unplug all plug-ups in stacker area.	3.5
13.	Operate planer.	3.3
a.	Fill oil cups for the heads with oil.	3.3
b.	Grease the fan motors, drive chain motors and all fittings with hand gun once a week.	3.3
c.	Change heads to fit the run if necessary and adjust to the correct size.	3.4
d.	Change knives once a week or as needed.	3.3
e.	Clean pit under planer daily.	2.8
f.	Keep a constant flow of lumber going through the planer.	3.5
g.	Run new loads onto the hoist and elevate to the infeed.	3.3
h.	Observe the planer for proper functioning.	3.5
i.	Gauge lumber as often as possible.	3.6
j.	Throw out lumber over the infeed table which will not go through the planer.	3.1
14.	Operate grader.	3.4
a.	Put ink on stamp.	3.3
b.	Make sure proper stamps are being used.	3.5
c.	Have a thorough knowledge of SPIB grading rules.	3.4
d.	Maintain 95% or better accuracy in grading lumber.	3.6
15.	Operate trimmer planer.	3.2
a.	Blow trimmer down.	2.9
b.	Start conveyor belt under trimmer.	3.2
c.	Check to make sure belts are operating properly.	3.2
d.	Start trim saws and chains.	3.3
(1)	See that limit switches are working.	3.3
(2)	Check stampers.	3.6
(3)	Make sure chain lugs are in line.	3.3
e.	Keep a constant flow of lumber feeding into the trim saw.	3.3
f.	Make sure all lumber is trimmed and properly stacked.	3.4
g.	Check to see that the lumber holddowns are in the down position.	3.2
h.	Change stamps for 6" and wider lumber.	2.9

16.	Perform tallyman duties.		3.4
	a.	Tally all incoming and outgoing lumber at the shipping area.	3.7
	b.	Load rail cars and/or trucks.	3.0
	c.	Have a knowledge of the date, number, size, length, and grade of incoming lumber.	3.6
	d.	Record information from load of outgoing lumber.	3.5
	e.	Put order number on outgoing lumber.	3.4
	f.	Notify send-in person if any problems arise.	3.2
	g.	Perform other duties as assigned.	3.2
17.	Perform mill maintenance.		3.0
	a.	Keep sprinkler system functioning and watch for unauthorized personnel on the premises.	3.1
	b.	Keep unauthorized personnel off premises.	2.5
	c.	Maintain and repair all electrical malfunctions.	3.3
	d.	Repair and maintain all mill machinery.	3.3
	e.	Weld all mill machinery in need of welding and assist in any mill machinery repair.	3.2
	f.	Sharpen saw blades when needed.	2.6
	g.	Repair and maintain all mobile equipment.	3.1

FIRE RANGER

Other Titles: Fire Patrolman, Fire Inspector, Smoke Chaser.

Job Description:

The Fire Ranger patrols an assigned area of a forest to locate and report fires and hazardous conditions, and to insure compliance with fire regulations by travelers in the field. Reports findings and receives and relays emergency calls, using telephones or two-way radio. Extinguishes small fires with portable extinguisher, shovel, and axe. May serve as crew leader for larger fires. May render assistance or first aid to lost or injured persons. May participate in search for lost travelers or campers.

Competencies Identified and Validated

N = 50*

Competencies		Weighted Mean**
1.	Be able to sustain self in remote areas for several days. (Camping skills).	2.6
2.	Have hiking skills.	2.7
3.	Obtain advanced Red Cross first-aid.	3.5
4.	Have knowledge of search and rescue techniques.	3.4
5.	Use a map and compass.	3.6
6.	Encourage safety among public.	3.3
7.	Know local and state fire laws.	3.4
8.	Have the ability to enforce fire laws.	3.3
9.	Keep records.	2.5
	a. Citations.	2.7
	b. Campers/Hikers.	2.6
	c. Water (rainfall).	2.6
	d. Water tables.	2.3
	e. Erosion damage.	2.0
10.	Know ground to aircraft signals.	3.0
11.	Know radio procedures.	3.2

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* Responses from 50 Fire Rangers in 22 states. Survey conducted by Occupational Education Program, University of New Hampshire, Durham, New Hampshire 03824.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

	a.	10-Codes.	3.2
	b.	Proper broadcasting procedures.	3.2
12.		Lay and splice telephone lines.	2.2
13.		Have the ability to ride a horse and care for a horse.	1.8
14.		Know four wheel drive.	2.8
	a.	Driving skills.	3.5
	b.	Maintenance and repair.	2.4
15.		Evaluate the damage of fires and area burned.	3.5
16.		Write reports.	3.3
17.		Work under minimum supervision.	3.5
18.		Serve as crew leader for larger fires.	3.4
19.		Have the skills of a forest fire fighter.	3.2
	a.	Know the behavior of fire.	3.6
	b.	Know the effect of topography, weather, and vegetation on the behavior of fire.	3.6
	c.	Know how to apply water to a fire.	3.5
	d.	Ability to extinguish flames and embers using:	
	(1)	A hand pump.	3.5
	(2)	An axe.	3.4
	(3)	A shovel.	3.4
	(4)	Engine-driven pumps.	3.4
	(5)	A chainsaw.	3.1
	e.	Know the capabilities of air support in fighting forest fires.	3.3
	f.	Ability to dig trenches and clear ground litter.	3.1
	g.	Have the ability to fell trees.	2.8
20.		Know the nomenclature, use and maintenance of:	2.8
	a.	Pulaski axe.	3.2
	b.	Hose.	3.1
	c.	McLeod.	3.0
	d.	Brush hook.	2.9
	e.	Council tool.	2.9
	f.	Nozzles.	2.9
	g.	Hazel hoe.	2.8
	h.	Lanterns.	2.8
	i.	Double-bit axe.	2.8
	j.	Grub hoe.	2.7
	k.	Brooms.	2.6
	l.	Two man cross-cut saw.	2.6
	m.	Kenny rakes.	2.6
	n.	Peevee.	2.5

o.	Fire swatter.	2.4
21.	Have knowledge of after fire mop-up procedures.	2.6

FOREST FIRE FIGHTER

Other Titles: Fire Crewman, Smoke Eater.

Job Description:

The Forest Fire Fighter works under the supervision of the Fire-Suppression Crew Leader. Suppresses fires, working along or as a member of a crew; fells trees, digs ditches, and extinguishes flames and embers to suppress fire, using axe, chainsaw, shovel, and hand or engine driven pumps; patrols burned area after fire to watch for hot spots that may restart fires. May cut brush, clear groundlitter, and ignite back fires to hasten burnout of major fire within contained area and to prevent its spread across fire lines.

Competencies Identified and Validated

N = 55*

Competencies	Weighted Mean**
1. Know the behavior of fire.	3.3
2. Know the effect of topography, weather, and vegetation on the behavior of fire.	3.2
3. Know the ten orders of fire safety.	3.3
4. Know the capabilities of air support in fighting forest fires.	2.3
5. Know how to apply water to a fire.	3.4
6. Have the ability to extinguish flames and embers.	3.3
a. Shovel.	3.4
b. Use a fire axe.	3.3
c. Hand pump.	3.3
d. Engine-driven pumps.	3.1
e. Use a chainsaw.	3.0
7. Be able to fell trees.	3.0
8. Be able to dig trenches and clear ground litter.	3.2
9. Be able to ignite a back fire properly.	3.1
10. Have basic Red Cross First Aid.	3.1
11. Know of after fire mop-up procedures.	3.2

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* Responses from 55 Forest Fire Fighters in 22 states. Survey conducted by Occupational Education Program, University of New Hampshire, Durham, New Hampshire 03824.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

12.	Have the ability to use a two-way radio.	2.6
a.	Know the use of 10-codes.	2.6
b.	Know the use of forestry codes.	2.5
c.	Know the proper broadcasting procedures.	2.7
13.	Know the nomenclature, use, and maintenance of:	2.6
a.	Nozzles.	3.0
b.	Hose.	3.0
c.	Chainsaw.	3.0
d.	Pulaski axe.	2.9
e.	Council tool.	2.8
f.	Double-bit axe.	2.8
g.	Brush hook.	2.7
h.	Fire swatter.	2.7
i.	Grub hoe.	2.6
j.	Lanterns.	2.5
k.	Two-man cross-cut saw.	2.5
l.	Hazel hoe.	2.5
m.	McLeod.	2.4
n.	Brooms.	2.3
o.	PeeVee.	2.2
p.	Kenny rakes.	2.2

FOREST INSECT RANGER

Job Description:

This is a sub-professional field work position. This position is assigned to a specific area and is responsible for inspecting and reporting on the disease and insect infested condition of forest and shade trees. When field identification is not possible, samples are submitted to a laboratory for analysis. Based upon results of surveys, the Forest Insect Ranger is expected to recommend appropriate eradication and control measures and must be able to accurately define the geographic limits of infestations for control by aerial spraying and other mechanical means. The worker in this position participates in considerable public contact work in acquainting landowners, citizens, and public officials with the nature of the control programs to be employed.

Competencies Identified and Validated

N = 35*

Competencies		Weighted Mean**
1.	Ability to orient self in woods.	3.9
2.	Ability to identify trees.	2.9
	a. By common Name.	3.5
	b. By buds and twigs.	3.1
	c. By bark.	3.0
	d. By shape of tree.	3.0
	e. By seeds.	2.8
	f. By scientific name.	2.5
	g. By aerial photography.	2.5
3.	Ability to identify diseases of trees.	3.1
	a. By common name.	3.5
	b. By damage caused.	3.5
	c. By specimen in the hand.	3.3
	d. Fungal disease.	2.9
	e. By scientific name.	2.8
	f. Bacterial disease.	2.8
	g. Viral disease.	2.8
4.	Ability to identify forest insect pests.	3.3

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* Responses from 35 Forest Insect Rangers in 22 states. Survey conducted by Occupational Education Program, University of New Hampshire, Durham, New Hampshire 03824.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

	a.	By common name.	3.5
	b.	By the damage caused.	3.5
	c.	In adult stage.	3.4
	d.	In nymph or larval stage.	3.4
	e.	By specimen in the hand.	3.3
	f.	In egg stage.	3.2
	g.	By scientific name.	2.8
5.		Pesticide use.	3.0
	a.	Ability to read and understand pesticide labels.	3.8
	b.	Ability to determine the proper pesticide and the proper application of pesticide to control forest pests.	3.6
	c.	Knowledge of the current local, state, and federal pesticide application laws.	3.6
	d.	Ability to operate a pesticide application device safely.	3.5
	e.	Knowledge of the classification of pesticides.	3.3
	f.	Ability to obtain a commercial pesticide applicators license.	3.2
	g.	Knowledge of the capabilities of aerial application of pesticides.	3.1
6.		Ability to quantify and define forest damage.	3.4
	a.	By plot work.	3.4
	b.	By map making.	3.0
	c.	By mensuration.	2.9
	d.	By photogrammetry.	2.7
	e.	By biometrics.	2.5
7.		Ability to keep accurate records.	3.4
8.		Ability to communicate effectively with the public.	3.3
	a.	Orally.	3.3
	b.	Written.	3.2
9.		Ability to work under a minimum of supervision.	3.3
10.		Ability to organize a days work.	3.5
11.		Possess a valid motor vehicle license.	3.7
12.		Ability to operate, maintain and repair small engines and pumps.	2.5

SMOKE JUMPER

Job Description:

Parachute from airplane into an inaccessible forest area to suppress forest fires. Orients self in relation to fire using map and equipment that are dropped by parachute from planes. Ascertain the best method of attacking the fire and communicate plan to plane or base camp by two-way radio. Fells trees, digs trenches, and extinguishes fires using axe, chainsaw, shovel, and hand or engine driven pumps. Prepares detailed written reports of activities and makes suggestions for all phases of parachuting smoke chasing, and fire fighting work assignments. Participates in scheduled physical conditioning and maintenance work while not performing fire suppression duties.

Competencies Identified and Validated

N = 47*

Competencies	Weighted Mean**
1. Obtain advanced Red Cross First Aid or equivalent.	3.8
2. Have knowledge of radio communications:	3.3
a. Knowledge of proper radio procedure.	3.4
b. Knowledge of Forestry Codes.	3.3
c. Knowledge of 10 Codes.	3.0
d. Knowledge of field repair.	3.0
3. Install antenna in trees.	2.9
4. Know hand signals for aircraft.	3.6
5. Know the capability of air support in fighting fires.	3.6
6. Know the behavior of fire.	3.8
7. Know the effect of weather, topography, and vegetation on fire behavior.	3.8
8. Know the ten orders of fire safety.	3.6
9. Relay water using Harodyke Bags.	2.4
10. Construct fire lines with hand tools.	3.8

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* Responses from 47 Smoke Jumpers in 22 states. Survey conducted by Occupational Education Program, University of New Hampshire, Durham, New Hampshire 03824.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

11.	Fell trees using:	3.4
	a. Axe.	3.6
	b. Chainsaw.	3.7
	c. Two man cross-cut saw.	3.3
12.	Have knowledge of hand and gas driven pumps:	3.1
	a. Operation of pumps.	3.3
	b. Trouble shooting pumps.	3.2
	c. Repair of pumps.	3.0
	d. Use of lubricants.	3.0
13.	Repair and maintain a chainsaw.	3.3
14.	Maintain self in remote areas for days (camping skills).	3.7
15.	Have knowledge of ropes and knots.	3.3
16.	Be compatible with people under pressure.	3.7
17.	Repair parachute.	3.0
18.	Pack parachute.	3,3

FIRE WARDEN

Other Titles: Woods Fire Warden.

Job Description:

Responsible for the planning and directing of all forest fire protection activities in the assigned area and the supervising of fire patrolmen, lookouts, and forest rangers in the construction and maintenance of all facilities and the equipment required and assigned in their jurisdiction. Examines and inventories fire fighting equipment, such as axes, fire hoses, waterbuckets, and chemical fire extinguishers, to determine the amount and adequacy of the equipment and requisitions additional equipment when necessary. Fire Wardens will take charge of fire fighting activities until relieved, recruit temporary help and equipment and coordinate the work of fire suppression crews. Inspect forest, logging and mill areas for fire hazards, and report hazards to supervisor of area involved. May be required to restrict public use of forest area during fire season.

Competencies Identified and Validated

N = 47*

	Competencies	Weighted Mean**
1.	Knowledge of fire prevention and suppression methods and techniques and the equipment used in the suppression of fires.	3.9
2.	Knowledge of the equipment used in the detection and locating fires.	3.9
3.	Knowledge of instruments for obtaining weather data.	3.5
4.	Ability to train others in the above competencies.	3.5
5.	Abibility to organize and direct fire fighting crews of considerable size.	3.8
6.	Ability to organize crews to aid in the search and rescue operations with other agencies.	3.1
7.	Working knowledge of forestry and related laws, rules and regulations and the ability to enforce them fairly and impartially.	3.2

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* Responses from 47 Fire Wardens in 22 states. Survey conducted by Occupational Education Program, University of New Hampshire, Durham, New Hampshire 03824.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

8.	Knowledge of technical forestry principles and practices.	2.7
9.	Knowledge of the use, care, and maintenance of forest fire control vehicles, machines, tools, equipment, and facilities.	3.5
10.	Ability to establish and maintain effective working relationships with other employees and the public.	3.6
11.	Capable of carrying on effective public relation programs in the field of fire prevention and suppression.	3.5
12.	Capable of recognizing fire hazards and the ability to correct the situation.	3.7
13.	Possession of a valid motor vehicle license.	3.8
14.	Ability to obtain a heavy commercial vehicle license.	2.8
15.	Ability to prepare accurate reports and present them clearly either orally or in writing.	3.6
16.	Ability to maintain complex records.	3.1
17.	Ability to prepare requisitions for fire control material and equipment.	3.4
18.	Knowledge of courtroom procedures.	2.7
19.	Ability to supervise maintenance of all fire fighting equipment, such as hand tools, back-pumps, hose, pumpers, tank trucks, and off road vehicles.	3.5
20.	Ability to perform strenuous physical and mental work for extended periods of time.	3.2

FOREST FIRE SUPPRESSION-CREW LEADER

Other Titles: Fire Protection Man, Crew Leader.

Job Description:

The Forest Fire Suppression-Crew Leader supervises and coordinates activities of crew that fells trees, digs ditches, and extinguishes flames and embers to suppress forest fires. Leads crew to area designated on a map by the Fire Warden and assigns workers to work stations along fire line. The Forest Fire Suppression - Crew Leader requisitions equipment and supplies for the crew. Assigns tasks to crew members to prevent over exertion of any one worker. Observes workers to detect signs of fatigue or illness from smoke inhalation and orders those affected to the base camp for treatment. Transmits information and receives instruction from the base camp or other units, using a portable two-way radio or other units. using a portable two-way radio or field telephone. May fight fire as a member of a crew. Submits time sheets for members of crew.

Competencies Identified and Validated

N = 51*

Competencies		Weighted Mean**
1.	Ability to recognize fire hazards and knowledge to handle these situations.	3.8
2.	Know the effect of topography, weather and vegetation on fire behavior.	3.7
3.	Know the ten Orders of Fire Safety.	3.6
4.	Ability to obtain Advanced Red Cross First Aid.	3.5
5.	Ability to obtain a Heavy Vehicle License.	2.9
6.	Ability to travel alone in a heavily wooded area.	3.5
7.	Ability to read and use a map and compass.	3.7
8.	Knowledge of the terrain and environs of the territory.	3.3
9.	Ability to prepare accurate reports and present them clearly.	3.3

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* Responses from 51 Forest Fire Suppression Crew Leaders in 22 states. Survey conducted by Occupational Education Program, University of New Hampshire, Durham, New Hampshire 03824.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

10.	Ability to maintain simple records.	3.4
11.	Ability to establish and maintain working conditions with associates, town officials, land and mill owners and the general public; and to secure cooperation in the fire prevention program.	3.0
12.	Ability to organize and establish fire lines and direct work crews for fighting fires and other activities.	3.8
13.	Physical stamina that is sufficient to perform strenuous labor involved in forest fire fighting.	3.6
14.	Ability to conduct fire suppression training schools.	3.1
15.	Ability to use a two-way radio.	3.2
a.	Knowledge of ten codes.	3.1
b.	Ability to broadcast properly.	3.3
16.	Ability to lay a telephone line.	1.8
a.	Ability to splice wires.	1.9
b.	Ability to set up a switch board.	1.7
17.	Ability to use a gas driven water pump.	2.9
a.	Knowledge of pump safety.	3.1
b.	Know how to run the six different types of water pumps.	3.0
c.	Know how to troubleshoot a pump.	2.9
d.	Knowledge of small engine repair.	2.7
18.	Ability to use a Harodyke Bag.	3.0
19.	Know the use of Back Fires.	3.5
20.	Know the capabilities of air support.	3.1
21.	Knowledge of fire mop-up procedures.	3.6
22.	Ability to use and repair tools.	3.0
a.	Council tool.	3.3
b.	Nozzles.	3.2
c.	Indian tanks.	3.2
d.	Brooms.	3.0
e.	Double-bit axe.	3.0
f.	Grub hoe.	2.9
g.	McLeod.	2.9
h.	Lanterns.	2.9
i.	Kenny rake.	2.9
j.	Peevee.	2.8
k.	Two man cross-cut saw.	2.8

CHRISTMAS TREE GROWER

Other Titles: Tree Farmer.

Job Description:

The Christmas Tree Grower is a person of many skills. The grower must be able to determine the suitability of an area for growing Christmas trees, plant and care for them, and harvest and market them. The grower is knowledgeable in the use of many hand and power tools and also has a general understanding of business. Basic job competencies include planting, spraying, shearing, harvesting, and marketing.

Competencies Identified and Validated

N = 85*

Competencies		Weighted Mean**
1.	Establish the Christmas tree plantation.	2.8
a.	Know what species are best suited for soil, topography, local climate, and site factors.	3.6
b.	Inspect and care for stock before planting.	3.5
c.	Obtain good quality seedlings.	3.4
d.	Determine number of trees to be planted and spacing to be used between trees and rows.	3.4
e.	Determine proper time of year to plant individual tree species.	3.3
f.	Determine suitability of topography and drainage.	3.2
g.	Operate safely chain saws, brush kings, machetes, etc.	3.2
h.	Maintain tools and equipment.	3.2
i.	Evaluate and understand future marketability and management systems for individual tree species.	3.0
j.	Lay out and maintain access roads and firebreaks.	3.0
k.	Determine suitability of soil by taking soil tests.	2.9
l.	Be aware of importance of planting several species where appropriate to avoid destruction of plantation by "host-specific" insects and diseases.	2.8

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* Responses from 85 Christmas Tree Growers in 32 states. Survey conducted by Department of Occupational Education, University of New Hampshire, Durham, New Hampshire 03824.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

m.	Plant seedlings using hand tools.	2.8
n.	Plant seedlings using mechanical equipment.	2.8
o.	Lay out rows using stake and cord method.	1.9
p.	Utilize space between trees for planting table-top trees and future crop trees.	1.4
q.	Lay out rows using compass and stake.	1.2
r.	Lay out rows using transit.	1.0
2.	Maintain natural stands.	2.6
a.	Weed out undesirable species by chemical or mechanical means.	3.0
b.	Maintain access roads and firebreaks.	2.8
c.	Shape and shear only better quality trees.	2.1
d.	Spot plants as needed.	2.0
3.	Control brush in plantation.	3.0
a.	Determine most effective type of herbicide to control grass, weeds, and brush while not damaging crop trees.	3.5
b.	Determine when to spray to control different species of grass, weeds, and brush.	3.5
c.	Prepare and store chemicals according to regulations and safety precautions.	3.5
d.	Comply with local, state, and federal regulations on the use of chemicals.	3.5
e.	Maintain a sound weed control program.	3.3
f.	Operate and maintain small tractor to mow grass and weeds between trees.	3.1
g.	Pass the "Private Applicators Test" for applying sprays on own land.	3.1
h.	Use and maintain hand pumps.	2.8
i.	Identify various grass, weeds, brush species.	2.7
j.	Use and maintain mist blower.	2.6
k.	Control stump regeneration of brush.	2.5
l.	Pass the "Commercial Applicators Test" for applying sprays on other's land.	1.8
4.	Control insect and diseases.	3.2
a.	Identify insects and their damage.	3.5
b.	Identify diseases and their damage.	3.5
c.	Determine when spray should be applied.	3.5
d.	Identify mechanical damage (herbicides, poor site, drought, mice, etc.) versus insect and disease damage.	3.4
e.	Know the effective life of each spraying.	3.2
f.	Operate and maintain spraying equipment.	3.2
g.	Determine method to be used to apply spray.	3.1
h.	Identify predators of harmful insects and understand effects of chemical treatment on beneficial insects.	3.0

	i.	Know life cycle of most common insects and diseases.	2.8
5.		Improve the quality of Christmas trees.	3.1
	a.	Shear each species at proper time of year.	3.7
	b.	Use hand clippers, shearing knife, or mechanical means to shape and shear trees.	3.7
	c.	Shape trees to achieve most desirable taper and fullness.	3.6
	d.	Know when to terminal prune to reduce growth between whorls.	3.6
	e.	Understand how a tree grows and responds to shearing and shaping.	3.6
	f.	Know how to shear lateral shoots and branches so that growth will be more dense.	3.5
	g.	Protect trees from fire.	3.4
	h.	Maintain shearing tools.	3.4
	i.	Determine when trees should be first sheared.	3.3
	j.	Protect trees from damage by livestock.	3.0
	k.	Know how to Basal prune branches at base of tree, when necessary, to increase foliage in upper tree and to produce a clear handle.	2.9
	l.	Determine fertilizer needed to improve growth and vigor.	2.7
	m.	Maintain fire equipment.	2.6
	n.	Operate fire equipment.	2.5
	o.	Select grade and ratio of fertilizer and apply it to stand to improve growth and color prior to harvesting.	2.5
	p.	Maintain sound fertilizing program throughout management period of plantation.	2.5
	q.	Use taper guide to shear trees.	2.4
6.		Harvest the trees.	2.9
	a.	Use harvesting tools and equipment.	3.5
	b.	Cut trees according to weather and species to insure that they remain fresh.	3.4
	c.	Know conditions under which trees will remain fresh while awaiting shipment.	3.4
	d.	Maintain harvesting equipment.	3.3
	e.	Select and mark trees to be cut.	3.2
	f.	Select harvesting equipment (saw, chainsaw).	3.0
	g.	Harvest trees to allow for easy handling.	3.0
	h.	Bundle trees for easy storage and shipment.	2.8
	i.	Know and apply as necessary, various techniques; i.e., by spraying, frosting, etc.	2.8
	j.	Eliminate cull trees while harvesting.	2.5
	k.	Branches pruned off at cutting and cull trees are saved for by-products like wreaths.	2.2
	l.	Be aware of stump culture.	1.9

7.	Market Christmas trees.	3.0
a.	Prepare income taxes and other forms.	3.8
b.	Keep records of receipts and expenses.	3.6
c.	Be aware of consumer preference in area.	3.3
d.	Have general knowledge of business management.	3.2
e.	Determine whether trees will be sold wholesale or retail.	3.1
f.	Market trees in advance of cutting season.	3.1
g.	Write sales agreements between buyer and seller stating a price for each species and quality, payment schedule, delivery date, liability, and other conditions of sales.	3.1
h.	Obtain appropriate insect and disease permits required for shipping Christmas trees.	3.1
i.	Understand appropriate federal, state, and local sources of marketing and silvicultural information and assistance.	3.0
j.	Set price for each tree depending on species, density, and height, grade and tag them, if trees are to be sold retail.	3.0
k.	Do an inventory of trees to be cut by age, species, height, density, and grade.	2.9
l.	Know national grading rules for Christmas trees.	2.6
m.	Have potential wholesale buyers inspect trees.	2.7
n.	Market low grade trees with premium trees for economic reasons.	1.9

MAPLE SYRUP PRODUCER

Other Titles: Sugarmaker, Maple Products Producer.

Job Description:

A Maple Syrup Producer must be able to perform a great variety of unskilled and skilled tasks. These tasks usually are performed on their own, under adverse weather conditions, including sub-zero temperatures, and often under considerable pressure of time. Few agricultural crops are so dependent on weather, requiring that the work be performed when the sap flows, whenever that might be, including weekends and late night hours. Examples of the type of work to be performed depend on the technology of the syrup operation. In a modern operation, plastic pipeline must be installed and maintained to create vacuum in the pipeline. The sap must be promptly boiled to standard syrup, graded, packaged, and marketed. In most operations the packaging and marketing must often be done throughout the year to obtain the best economic return for the crop. Other maple products such as sugar and spreads may be made, packaged, and marketed. In a wood-fired operation, fuel for the evaporators must be cut, split, stored, and dried a year before the time of use. Tapping trees, installing tubing, handing buckets, and collecting sap with a tractor or horses and sled must be done, often in deep snow. Employment in this occupation is by private industry.

Competencies Identified and Validated

N = 48*

Competencies			Weighted Mean**
1.	Have knowledge of terrain.		3.0
	a.	Determine the correct layout of tubing lines or a road network.	3.7
	b.	Establish grade lines for pipelines or for roads.	3.4
	c.	Locate roads for ease of equipment operation and for maximum efficiency in gathering sap.	3.1
	d.	Make maps for pipeline system or for collecting roads.	2.4
	e.	Determine soil conditions, plan for drainage to prevent erosion, and avoid pollution.	2.2

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* Responses from 48 Maple Syrup Producers in four states. Survey conducted by Department of Vocational Education and Technology, University of Vermont, Burlington, Vermont 05401.

** 4.0 = Essential; 3.0 = Important; 2.0 = Of Some Importance; 1.0 = Not Important; 0 = Does Not Apply.

2.	Have knowledge of trees.	2.9
a.	Select trees for tapping.	3.3
b.	Establish correct number of taps per tree.	3.3
c.	Tap trees to correct depth avoiding old tapholes or other wound wood and hollow trees.	3.2
d.	Establish means of removing trees for firewood or other use without damaging crop trees.	3.1
e.	Establish sugar bush management procedures such as weeding, thinning, selection of reserve trees, planting, and other details to ensure the best growth and highest production of sweet sap.	2.8
f.	Recognize injurious insects and diseases, have some knowledge of control methods.	2.4
g.	Test trees for sap sweetness.	2.2
h.	Know how a tree grows and manufactures its food, and why sap flows.	2.0
3.	Have knowledge of sap collection.	3.3
a.	Lay out pipeline system to take advantage of grade and other terrain features.	3.6
b.	Install pipeline system to make most efficient system avoiding sags, kinked drops, etc.	3.6
c.	Calculate proper pipeline sizes for numbers of taps involved.	3.5
d.	Prepare sap storage facilities of adequate capacity in a cool, protected area.	3.2
e.	Plan for and install vacuum pumps of correct size to overcome lack of grade and give maximum production during "weeping" flows.	2.9
f.	Perform maintenance and minor repairs on electrical and internal combustion equipment.	2.7
4.	Have knowledge of syrup making.	3.3
a.	Operate evaporator correctly.	3.8
b.	Utilize instruments (hydrometer or refractometer and thermometer) properly to determine syrup density.	3.6
c.	Recognize and use efficient firing methods to secure highest syrup quality at lowest energy cost.	3.5

d.	Utilize proper cleaning and handling procedures to keep sap, syrup, and equipment in sanitary condition.	3.5
e.	Decide how to store or pack syrup in regard to market requirements.	3.4
f.	Be able to drill, solder, and rivet metal, also do carpentry work to keep evaporators, sugar house, and other equipment in good repair.	2.7
g.	Utilize principles of basic electrical wiring and plumbing to install, operate, maintain, and repair syrup and syrup products processing equipment.	2.6
5.	Have knowledge of marketing.	3.0
a.	Keep track of costs, compute profit margin, and sell for prices which keep business profitable.	3.3
b.	Obtain markets to secure best return on crop.	3.2
c.	Establish those public relations methods to aid in securing best markets.	2.9
d.	Prepare other maple products to satisfy markets.	2.4
6.	Have knowledge of planning.	3.0
a.	Secure supplies and materials for sap collection and syrup production for best economic return.	3.2
b.	Plan for, hire, and supervise seasonal labor.	3.2
c.	Plan to match amount and type of products to market; e.g., container size, type, and syrup grade.	2.9
d.	Plan additional markets for bumper crop years and alternate sources of supply in short crop years.	2.7
7.	Have knowledge of record keeping.	3.1
a.	Have knowledge, if full-time business, of financing, accounting, and merchandising.	3.3
b.	Maintain adequate expense and sales record for tax and other purposes.	3.2
c.	Maintain adequate production and sales records to evaluate forest management production and marketing decisions.	2.7

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